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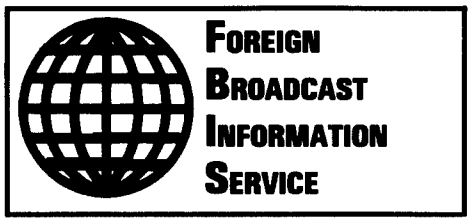

JPRS Report

Arms Control

REPUBLIC OF SOUTH AFRICA

Company of the Year: ARMSCOR

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Corporate Overview

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 2

[Article: "Creating the Leading Edge Against All Odds"]

[Text] It has been said often enough (sincerely, cynically and otherwise) that "war is good for business".

But who would have thought 12 to 15 years ago that South Africa's military involvement in Namibia and Angola, regions far-removed from our industrial heartlands, would have created a vibrant industry employing (directly and indirectly) more than 90,000 people and earning our largest slice of foreign exchange for manufactured goods?

Remarkable Evolution

Armscor's remarkable evolution over a mere 12 years is, indeed, a special success story for South African industry and national defence.

From what must have been a seemingly elusive dream in the mid-70s, Armscor—the Armaments Corporation of South Africa—was founded officially in 1977 as a result of the United Nations' sudden and unconditional embargo placed on the supply of armaments and other defence equipment to South Africa.

An old cliche was turned on its head virtually overnight: if you can't join them, you beat them!

November 4, 1977 was the day that changed the fortunes of South Africa.

The UN Security Councils' total and compulsory arms embargo on this country set in motion the formal foundation of a complete South African armaments industry embracing the design and manufacture of aircraft, tanks, armoured cars, naval vessels, helicopters, artillery equipment and consumables, rifles, missiles, ammunition and much more.

Five years later Armscor was in Athens, Greece, proudly exhibiting state-of-the-art armaments to a somewhat startled international defence community.

Since then Armscor has gradually been carving itself a significant niche in the international market as a considerable supplier of combat-proven products.

By 1988, Armscor was trading with more than 25 countries in what has been traditionally regarded as a highly competitive and complex market exacerbated by South Africa's political and economic ostracisation from the global community.

Today, South Africa has the most advanced and comprehensive armaments production industry in the Southern Hemisphere—and the corporation's executive is pragmatic in its optimism that South Africa will remain at the vanguard of armaments design, production and trade.

Ingredients for Success

It is difficult to summarise the ingredients of the Armscor success story. But what emerges from ENGINEERING WEEK's extensive research and interviews are several key factors:

- The Government's ability and willingness to channel financial and other resources into the corporation;
- The powerful human synergy nurtured by integrating the manifold disciplines of both private and public sector executives and specialists such as engineers, scientists and technologists in addressing priority needs;
- Armscor's ability and willingness to invest millions of rands in carefully assessed and directed training programmes from apprentice level to post-graduate studies.
- Innovative, highly pragmatic and well-co-ordinated research and development programmes;
- Armscor's insistence on pursuing the highest and most advanced quality assurance methodologies possible;
- Easy accessibility to one of the best testing grounds in the world—the harsh bushveld of South Africa, Namibia and Angola where a sophisticated guerrilla war was being fought for so long;
- The tremendous support and enthusiasm for the South African Defense Force (SADF) in specifying design and performance requirements and in giving illuminating feed-back on Armscor products in real-life war situations;
- And an all-round systematic form of entrepreneurial management and leadership in which every effort was made to de-bureaucratise the Armscor corporate culture.

With assets worth many billion rands and an annual turnover of about R5-billion, Armscor is a formidable industrial giant rooted firmly in the private sector.

Armscor at a Glance

Main Products:

- aircraft, including helicopters and fighter jets;
- frigates and other naval vessels;
- tanks and armoured cars;
- specialist military vehicles such as ambulances, troop carriers, and supply and recovery trucks;
- artillery guns and systems;
- combat and sport rifles and ammunition;
- missiles, mines, bombs, mortars and allied consumables;
- a wide variety of sophisticated electronic systems;
- and combat communication systems.

Clients:

- SA Defence Force (the Air Force, Army and Navy);
- SA Police;
- Prison Service;
- other members of the national security community;
- and select commercial and international clients.

Main Competitive Advantages:

- involvement in formulating needs;
- comprehensive product range;
- management expertise for complex projects;
- all-around progressive management techniques;
- quality - people, systems, products and services;
- use of unique international trade instruments;
- excellent ties with industry;
- and assurance of systems integrity.

Key capabilities:

- complete marketing capability;
- ability to provide user-appropriate systems for complete client satisfaction;
- the resources to design, develop and support unique products and technologies;
- flexibility and adaptability to ensure changing client needs and technological trends are met;
- ability to recruit, develop, maintain and use high-level personnel;
- ability to remain price-competitive;
- sound interactive planning skills with clients, contractors and other associates;
- effective communication;
- and commitment to life-long produce and systems support.

Corporate Structure

Armscor and its subsidiaries, along with its private sector relations, ahve been structured meticulously to ensure the optimum procurement, design manufacture and testing of armaments primarily for current and projected South African defence requirements.

Armscor itself is, essentially, the organisation that interfaces with its clients—primarily the SADF and the South African Police (SAP)—and manufacturers (both Armscor subsidiaries and independent private sector companies).

It oversees procurement, design, quality assurance, communication, negotiation, research and development, manufacture, testing, sales, marketing, training and human resource development, and finance and administration.

Armscor Subsidiaries

Armscor has 10 fully-owned subsidiaries plus a few specialist facilities such as Gennan, Milistan and Overberg. The corporation also owns several test sites including those at Overberg, near Bredasdorp in the Southern Cape, St Lucia in Northern Natal, the Alkantpan ballistic test site in the Northern Cape and the Eugene Marais vehicle test site west of Pretoria.

Atlas Aircraft Corporation (Kempton Park) Aircraft manufacture, maintenance and servicing.

Telecast (Kempton Park) High-tech alloy castings.

Lyttelton Engineering Works (Verwoerdburg) Manufacture of small arms, mortars and artillery systems.

Eloptro (Kempton Park) Optical and electro-optical equipment manufacturer.

Kentron (Pretoria) Guided-weapon system design and manufacture.

Naschem (Potchefstroom) Filling of mortars and aircraft bombs, heavy-calibre ammunition and mines.

Swartklip Products (Cape Town) Pyrotechnical product and commercial ammunition manufacture.

Infoplan (Pretoria) Computer services.

Pretoria Metal Pressings (Pretoria) Small arms and quick-fire and ammunition manufacture.

Somchem (Somerset West and Wellington) Manufacture of propellants, explosives, rocket-propellant systems and rockets.

Musgrave Manufacturers and Distributors (Bloemfontein) Hunting rifle, shotgun and small handgun manufacture.

Houwteq (Elgin, Southern Cape) Missile systems.

Facilities: Gennan, Gerotek, Milistan, Overberg Test Range, Armatron.

Chairman's Interview

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 6

[Interview with Johan van Vuuren: "Armscor Ready To Meet New Challenges"]

[Text] Armscor executive chairman Johan van Vuuren—born in August 1937—has worked with the corporation for 19 years.

A bachelor of commerce graduate from the University of Pretoria, he joined the old Armscor in 1971 as an auditor after an initial career with the Transvaal Board for the Development of Peri-urban Areas and the City Council of Pretoria.

In 1972 he was promoted to general manager of subsidiary Lyttelton Engineering Works and played an instrumental role in laying the foundation for establishing South Africa's manufacturing capability for advanced weapon systems, especially infantry and artillery systems.

In 1977, at the time of the United Nations arms boycott against South Africa, Van Vuuren was promoted to Armscor's top management team and contributed to the restructuring of Armscor and its activities.

As senior general manager: internal production, he was responsible for Armscor's internal manufacturing operations at 11 companies employing 20,000 people.

In July 1986, after the retirement of Fred Bell, he was appointed executive general manager (equivalent of group managing director) and performed a major strategic role in shaping Armscor into an even more client-orientated organisation with international interests. Three years later (August 1989) he was appointed executive chairman after the retirement of Commandant Piet Marais.

Described by senior colleagues as "diligent, conscientious, inspiring and disciplined", Van Vuuren is also regarded as a hands-on leader dedicated to building highly motivated teams.

Outside of Armscor, he is a member of the Scientific Advisory Council and of the Advisory Committee of the University of Pretoria Post-Graduate Management School.

His extramural interests are sport and wildlife.

Married with four daughters, he has received three notable decorations: the Star of South Africa (Class III: Commanders in 1985, and the Grand Officer (Silver) in 1988); the South African.

Police Star for Outstanding Service in 1988; and the Special Cravat of the Order of the Resplendent Banner Taiwan in 1982 and the Higher Order in 1988.

In a brief but candid and insightful interview with ENGINEERING WEEK, Armscor executive chairman Johan van Vuuren updates the engineering community on the corporations' aspirations, challenges and values.

The following is an edited transcription of the interview.

[ENGINEERING WEEK] Did the Company of the Year nomination surprise you, or do you believe such a nomination to be recognition that your goals have been achieved positively?

[Johan Van Vuuren] No, I was nor surprised but rather satisfied in being bestowed such an honour. It is recognition of what we have been trying to do for the South African defence and industrial communities.

[ENGINEERING WEEK] Looking at the wider South African community, especially the economic, defence and industrial realities we face, what do you consider to be Armscor's key achievements over the past decade?

[Johan Van Vuuren] There have bene three main achievements. Firstly, the responsibility we were given to establishing a viable armaments industry with private enterprise to make South Africa self-sufficient in armaments as a result of the UN embargo in 1977. We've achieved that by making as little as possible ourselves while giving as much opportunity as possible to private industry.

Today, there are 975 private companies benefiting from our industrial programmes.

The second notable achievement is the high support we have gained from the SADF (Defence Force), our main client, in designing local products for local conditions and needs.

I believe we have been successful in every regard.

The third notable achievement has been our moderate success in the export market against a background of total boycotts and international opposition to South Africa.

As for our future achievements and aspirations, we have to be realistic becuse so much of our business depends on economic and political factors beyond our control.

More particularly, a lot will depend on what happens in Namibia (Van Vuuren was speaking on the eve of Namibia's recent general elections which swept Swapo into power).

We obviously expect less activity in our consumable areas such as ammunition but we've planned for that. Corporate planning forecast this trend more than a year ago and followed this with rationalisations.

The one Naschem plant was closed and people were retrenched and now we've just retrenched people at Pretoria Metal Pressings.

Armscor is working on many longer-term projects, many of which are sophisticated. These will definitely continue in the interests of national defence.

Defence Spending

The extent of these projects will, of course, depend on the amount of funds allocated for defence spending.

Our long-term strategic plans will be adapted to whatever defence requirements are set.

We have realistic expectations and keen vision as a top management team with well-developed systems for planning and forecasting. So far we have been successful in analysing and producing our armament needs through our excellent relations with the SADF.

[ENGINEERING WEEK] What areas in your operations and relationships with the private sector do you believe need special focus to take Armscor to even higher performance levels?

[Johan Van Vuuren] Several aspects need refining. For example, life-cycle and ownership costs of weapons systems are important and we have to enhance our

ability as well as that of the subcontractor to help improve life cycle costs farther.

Productivity is another opportunity of Armscor and private sector suppliers. There are areas for growth and improvement, especially considering our role in the international market.

We are also looking at ways of lowering our prices on the international market, an especially demanding challenge considering how bad our inflation is compared with First World trends.

Labour costs are major and need considerable attention, too.

There is also going to have to be greater emphasis on first-time-right principles. There is still room for improvement. This drive will help to keep prices down.

[ENGINEERING WEEK] Countries have to be prepared for war at all time and, no doubt, this remains the policy of both the Government and the Defence Force. But will Armscor have the opportunities to sustain its research and development record in bringing to the defence community more combat-efficient technologies such as improved fighter jets and artillery guns?

[Johan Van Vuuren] We feel much remains for us to keep going and evolving in many fields. Budgets will determine priorities.

We've been working with a shortage of skilled manpower and have been over-stretched.

Now we will have more of an opportunity to work within our limits particularly in terms of manpower.

There are many programmes that should still allow us to have a major influence on development and international exports.

It's a known fact all around the world that the armaments production environment is always the leading edge of manufacturing industries and South Africa is no exception.

Namibia

[ENGINEERING WEEK] Will peace in Namibia encourage Armscor to explore new export opportunities for its products and services—not only in terms of new products but also in terms of new and better approaches and service levels?

[Johan Van Vuuren] We have been looking at greater export opportunities. We now have more expertise available and are exploring some ideas we had to shelve and now believe we are more able to design products for overseas customers' requirements.

Our prime aim has been to design for the local market first and foremost. We could then adapt these designs for our overseas customers.

As far as special development work goes, whether its for local or international customers, we need someone to help foot the bill.

It is important to stress that Armscor has shown the broader South African manufacturing environment that we have the ability to tackle major countries as competitors.

Uniqueness

Armscor has demonstrated that we can design and produce products that compete internationally because of their uniqueness (the G5 and G6 artillery systems being good examples).

Armscor has given a lot of people more confidence in themselves and their abilities.

By working in affiliation with Armscor, some companies have had their first taste of exports and are now looking at export opportunities for their commercial products.

[ENGINEERING WEEK] Some rationalisation has already occurred in the corporation with retrenchments at Pretoria Metal Pressings. Are additional rationalisation measures being considered—and if so, can you outline the practical considerations?

[Johan Van Vuuren] Rationalisation is a sustained effort. We review our needs yearly and are renowned for our ability to adapt to change. Early this year we may well have to consider other aspects of rationalisation depending on Government spending.

Pretoria Metal Pressings' rationalisation, for example, was based on a vision we had and was well-planned. Beyond that, it's a matter of wait-and-see.

I believe the future managers of South Africa will ahve to be more flexible.

We can foresee future technology trends and requirements accurately and this helps us to determine our management needs and direction.

[ENGINEERING WEEK] Armscor has been exemplary in dealing with the country's skills shortage by investing many millions of rands in training and education programmes. Will this trend continue—and, if so, could you elaborate on the factors influencing your manpower development plans for the next decade?

[Johan Van Vuuren] There will always be a strong emphasis on people, our most valuable resource.

Over the past five years, in particular, there has been a strong shortage of skilled manpower but we now see a more normalised situation for the near future.

We see a more practical approach emerging in our manpower development programmes. For example, bursary holders should in future spend more time "going through the mill".

We want young engineers, for example, to spend more time doing design and production than the more paper-orientated engineering work.

In terms of technologists and technicians, we will continue to make substantial investments. Armscor was one of the first organisations to appreciate the importance of these technical skills and has committed itself to highly practical education and training.

Skilled People

There will be a sustained effort to help skilled people develop an optimum career path and to enjoy high-level job satisfaction and recognition.

[ENGINEERING WEEK] Armscor has also been singled out as a guiding light in two important industrial areas: the promotion of optimum technologies and the stringent applicaiton of quality assurance programmes. How do you see armscor's future rule in these two critical areas?

[Johan Van Vuuren] Our success is determined by the performance of our products and services and client satisfaction.

We have created momentum for "getting it right first time"—and that's a culture we have to maintain.

I don't expect our companies and suppliers to slump into their old ways of management without good technology and proper quality assurance.

What we need as a country are a few private sector entrepreneurs that have had the advantage of new-technology experience in the armaments industry and who can run with this ball and create momentum and new opportunities.

The skills and training they have acquired must now be used to improve and develop commercial products for the overall well-being of South Africa.

[ENGINEERING WEEK] Legislation stipulates the corporation may not make a profit exceeding about four percent of its turnover. Profit is normally the bottom-line objective of any corporation, so what drives Armscor as a business entity—and how do you measure your performance?

[Johan Van Vuuren] We can't just manufacture at any price. Our local clients are aware of realities and keep lists of international prices and therefore know whether we are in line with trends or not.

Prices

Products and prices have to be measured against international trends. It has to be a good example of productivity and quality. That's a way of measuring our performance. We constantly seek to emulate and even exceed international standards rather than restrict ourselves by looking at local standards only.

We are also driven by a need to compete more aggressively on the international market—we want more success in spite of political issues.

We are also concerned about keeping our international prices keen. Our culture is about as "private" as it can be.

There are certainly no bureaucratic aspects.

[ENGINEERING WEEK] Are there major capex plans for the near future?

[Johan Van Vuuren] No, nothing new on the drawing boards. We have invested heavily for the past two decades. Now the focus is to use our resources to our best advantage.

[ENGINEERING WEEK] Over the next decade there will more than likely be tremendous pressure on the corporation to maintain its competitive advantage, especially if there is no SADF involvement in a full-scale war in which one can evaluate the real-life combat-effectiveness of new products. How will Armscor deal with this challenge?

[Johan Van Vuuren] Well, we are getting interesting feedback from countries using our products. That helps a lot.

But, more important, environmental testing and simulation have evolved so far, you can rely on them although we always admit the proof of the pudding is in the eating.

Enterprising

A lot will depend on the Namibian situation. Logistics have changed remarkably in recent years and existing products will have to be adapted for new and different circumstances. We are flexible and enterprising enough to meet whatever challenges come our way.

[ENGINEERING WEEK] Mr Van Vuuren, before we conclude, perhaps there are some issues we haven't covered?

[Johan Van Vuuren] We don't expect a relaxation of sanctions in the near future. The perception of South Africa overseas has a major influence on our business and organisation.

The harder the international attitude, the more determinedly will we strive to achieve our goals. We hope South Africa will improve her image abroad.

In terms of human resources, more children should be encouraged to embark on an engineering career if this country is to tap its full economic benefit and become a major player on the international market.

The defence industry is the traditional leader of technology. If you kill it, we will all step backwards technologically.

The economic performance of a country at large is also important and we can make a sustained contribution.

In terms of the environment, we are sensitive about our environment and will sustain all environmental activities as a matter of corporate responsibility and national concern.

Technology Overview

34000458A Johannesburg ENGINEERING WEEK in English 1989 pp 7-8

[Article: "The Great Technological Offensive!"]

[Text] Winning a war or simply defending a nation requires four main ingredients: well-trained and motivated personnel; capital; appropriate offensive and defensive strategies; and combat-proven technology.

While the first three key ingredients are the South African Defence Force's (SADF) responsibility, the development and manufacture of combat-proven technology is Armscor's ambit.

Considering the sudden arms embargo against South Africa as well as the country's lack of technical skills and state-of-the-art engineering technologies in the 1970s, Armscor and its suppliers have executed a fine job in moving rapidly and successfully to the forefront of technology.

What makes this accomplishment all the more amazing is the sheer diversity and complexity of Armscor's product range: sophisticated fighter jets; rugged, powerful, high-speed tanks and armoured vehicles; intelligent missile systems; highly accurate long-range artillery guns; and hardy automatic rifles, among hundreds of other products.

Armscor has not only proven to the world that it can compete with the best armament manufacturers in the East and West.

It has also developed several "world firsts" in the field of intelligent defence systems.

All the key technical Armscor executives spoken to stressed one key fact: it is absolutely vital that the corporation sustains a concerted effort to keep itself at the forefront of technology.

Considerable resources therefore are invested in refining, improving and updating existing technologies.

As one executive remarked: "Technologically related risks have to be reduced to zero when it comes to protecting the lives of a defence force and the nation it defends. The enemy cannot for one day be afforded any advantage on the basis of superior technology.

"This is one of the great fundamental values that has driven Armscor since its inception.

"As modern warfare becomes more complex and expensive and as the enemy's arms improve in design and performance, we will be driven to produce more and more intelligent and effective systems.

"But, while we use a considerable amount of high technologies, the main objective is to make these defence systems easy to use, maintain, secure and transport while also assuring longevity, reliability and complete user satisfaction.

"You can't therefore ever underestimate the power of technology."

It is not only the technology used in defence equipment that counts, but also the technology employed in designing, manufacturing and testing equipment.

Whether it's welding or profiling equipment, metrology and non-destructive testing (NDT) systems, high-speed photography, computer-aided design and manufacture (CAD/CAM) systems, or metallurgical processing technologies, Armscor's subsidiaries and suppliers are winning on the technology battlefield.

Regrettably, security constraints forbid an in-depth look at the type and advantage of technologies employed by Armscor affiliates.

By looking at the company's product profile, however, one can appreciate the sophistication and effectiveness of the technologies used.

Specialist Vehicles

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 10

[Article: "Rapid Evolution of Specialist Military Vehicle Technology"]

[Text] The complexity of modern military requirements has led to the rapid evolution of a wide variety of specialist combat and combat-support vehicles to ensure any army is wholly effective on all technology and equipment fronts.

In this regard, Armscor—through the specialised resources of its Special B Vehicles facility—has in little more than a decade emerged notable producer of specialist, heavy transport vehicles for the SADF [South African Defense Forces].

According to a facility spokesman: "Special B Vehicles is a systems house as product level and a private company within Armscor's Engineering Department. It functions on business principles and is financially self-supporting.

"The company functions at arm's-length, supporting the Armscor programme manager. The Armscor affiliate marketing manager and programme manager are the main clients."

Special B Vehicles' (SBV) mission is to design and develop specialist heavy vehicles for military and related

support roles. This involves building prototypes and short production series manufacture. The company also specialises in designing and prototyping various subsystems mainly in the structural and hydraulic/pneumatic disciplines. In the case of short production runs, the company also maintains a total life cycle logistic support.

The company manager programmes amounting to an annual turnover of about R20-million with individual total contract values varying between R50,000 and R30-million. Typical programmes being handled include:

- specialist extra-heavy vehicles with a gross mass of up to 75 tonnes;
- superstructures the structural and hydro-pneumatic disciplines, e.g. recovery vehicles; and
- adapting equipment for special purposes.

SBV prototypes for the Ratel logistic vehicles, Olifant tank and a mine-detection vehicle have also been manufactured.

Said the spokesman: "The programme manager is the nodal point with any client. He obtains the human resources from the specialist divisions of the company or other facilities in Armscor's Engineering Department on a matrix basis.

"Programmes are planned and executed within the guidelines of the corporate policies, procedures and standards specified by Armscor.

"The programme manager also has the support of computer-based programme planning systems, configuration management systems, quality assurance systems and commercial and legal specialists within the company and Armscor head office."

SBV's development division is structured to undertake the design and development tasks of high-risk, short production-run vehicles.

SBV functions as a design house on product level during a project's validation and development phases. Conceptual design tasks are normally subcontracted to other system houses. In the case of projects viable for production, SBV subcontracts the industrialisation and production phases to the private sector.

The development division, he continues, is fully responsible for producing a required product's detailed design. To this end, five specialty engineering fields were created within the division: automobile, structural, hydraulic and pneumatic, automotive electrical and general mechanical engineering. Each section is led by an experienced engineer or technologist.

Explained the spokesman: "An interrogator is appointed for each project. The integration is the nodal point of the design team and the integration of a multi-disciplinary design project is co-ordinated as such. The interrogator is responsible for creating the master record index (MRI) and all assembly and interface drawings and documents necessary to describe the product.

He continued: "SBV's production division comes into play after a design has been completed by the development division and released for production by the programme manager.

"The production division is a dynamically integrated unit comprising production scheduling, materials management, assembly, logistics, and model-building and manufacturing analysis functions.

"The process flows naturally through the steps of detail planning for various activities, purchasing materials and services and storage of items before producing the required systems and subsystems."

A computer is used to maintain and create a variety of databases. PERT diagrams are generated and based on the production sequence logic maintained on the computer. A customised program facilitates data retrieval and input regarding parts required, delivered changed or returned. All purchases are initiated by the production planning department according to a materials plan and the production requirement. A purchase request is accompanied by all relevant technical documents including drawings and specifications.

He continued: "The materials management section is responsible for purchasing and storing components and parts. Purchasing is distinguished from buying in the sense that it is a technical function whereby the purchaser, as the only initial liaison with a firm, has to interpret and discuss the contents of technical documents for the firm to prepare quotation.

"Obviously, standard items and a variety of service are also acquired. Pre-contract discussions are held with larger contractors and special attention is paid to the prerequisite contractual conditions and procedures."

A430 square metre store is used to hold about 20,000 items.

The production facility, according to him, is not suited for continuous or mass production. Production concentrates on assembling prototypes or small production runs. The main function is to prepare, assemble and/or install all electrical, pneumatic, hydraulic, mechanical and structural components and sub-assemblies. All work is conducted according to an approved assembly product manual compiled internally.

Similar to the requirements for software configuration control, hardware configuration is controlled stringently and a procedure for deviations, concessions and engineering changes is upheld.

Production interfaces with the development division to discuss new concepts and changes. The production division has developed excellent capabilities in fields such

as: integration and assembly of high-technology transport vehicles; hydraulic and pneumatic fitting; welding; spraypainting; and fibre technology.

He continued: "An added advantage of experience is the capability to assist clients in formulating mutually or developing progressively a specific requirement."

The production facility is supported by a large variety of equipment such as: overhead cranes; compressors coupled to an air supply system; an integrated air-cleaning system; a profile cutter; various welding equipment; an hydraulic press; hydraulic jacks; and various machining equipment for turning, milling, grinding, drilling and cutting.

SBV's logistics section delivers the necessary support to ensure users can maintain products or systems for their expected life cycle. This function entails developing and/or supplying technical manuals, special tools, scaled part lists, logistical spare parts and maintenance schedules as well as determining and demonstrating products maintainability.

The facility's model-building and manufacturing analysis department supports the development division. Models are fabricated on a 1:1 or 1:5 scale for verifying designs or to demonstrate problems regarding interfaces between systems. In this process, a design's manufacturability and cost-effectiveness are considered in relation to aspects such as ergonomics, material choice and manufacturing resource optimisation.

SWBV's technical services unit delivers support services in the fields of configuration management, quality assurance, planning support services and drawing office services.

"Configuration management ensures project baselines are managed and controlled centrally. This is done according to guidelines stipulated by Armscor's system configuration.

"Quality assurance is the responsibility of every SBV employee. The quality assurance section ensures completed products are delivered according to client specifications.

"This starts by giving quality requirement input at the design stage. Quality acceptance criteria for components, subsystems and completed systems are established before production starts. This ensures production personnel know exactly to what standard products have to be manufactured. During the manufacturing process, completed and partly completed products are inspected and tested according to the quality acceptance criteria."

The spokesman continued: "Quality inspection is done when subcontractor materials, components or systems are delivered as well as at subcontractors' premises."

SBV's planning section uses a customised computer software package to ensure projects and resources are planned and controlled effectively. This enables management to know a project's status at any stage and to make timeous corrections if necessary.

The facility's drawing office comprises a design and production section. Using the client's requirement specification as a baseline, conceptual drawings and documentation are prepared using two and three-dimensional computer-aided design (CAD) equipment. Wire-frame and solid models are also CAD-generated as required.

Preparing manufacturing data-packs is performed either manually or by using two-dimensional CAD equipment. The data-packs are normally for the manufacture of prototypes and limited production (multi-detail drawings) or for full production (single detail drawings). The base draughting standard is the Armscor draughting specification (SK 069 and RM-STO-32) or as specified by the client.

Houwteq Technologies

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 11

[Article: "A Value-Driven Team"]

[Text] Armscor facility Houwhoek Technologies (Houwteq), in keeping with its well-shrouded activities and intense high-tech culture, is nestled amid the breathtaking apple orchids and conifer forests of Elgin, west of Cape Town en route to Caledon.

Houwteq, according to the company's communications chief, Fanie Gerber, was established in 1987 to increase the country's industrial capacity for advanced armament systems.

Says Gerber: "The defence of South Africa in years to come is Houwteq's business.

"Its task is daunting and its industry complicated, but it has made a solid start in what management describes as a contribution to the country's high-tech industry in general.

"The challenges facing Houwteq require courageous strategic thinking in terms of organisation and project execution. Our job culture is of primary importance."

He continues: "Having assembled a dedicated team of more than 100 engineers and computer scientists, the organisation's high-tech nature, together with the urgency with which tasks are approached, demands a rapid formation of a closely knit, well-oiled and value-driven team with team being the operative word."

The Houwteq value system comprises five main elements:

- Managing to objectives;
- Ensuring technical integrity in its products;
- Living close to the customer;
- Ensuring quality of work life for its employees;
- And being a responsible community member.

"It is accepted by management, "Gerber continues, "that this value system has to be supported by individuals' commitment to teamwork, thorough planning and offering value for money.

"Thus these attributes are promoted actively."

Settling in one of the country's most beautiful and pristine environments that has little industry outside of apply growing and processing entailed a special effort to establish cordial relations with the surrounding community.

"Houwteq's commitment to managing the local natural environment has gone a long way towards establishing the company's credentials—not only with the local community but also in the eyes of the environmentalists," says Gerber.

"Houwteq established an innovative environmental control plan in association with some of the country's most respected environmental specialist such as Cape botanists and zoologists.

"The well-structured plan ensures that the impact of construction and operation at Houwteq's emergent industrial complex on the environment is limited.

"The plan has been hailed by prominent conservationists as setting new standards for industries settling in sensitive ecological areas."

ENGINEERING WEEK's visit to the Houwteq site was certainly encouraging. Aside from an abundance of wildlife such as antelope, birds and lizards to be seen, the Houwteq environmental team has long been hard at work restoring patches cleared for development, ensuring only indigenous flora and fauna are repropagated.

Turning to human resources he says: "Recruiting and training the right people for the job is a priority.

"Apart from staff in service departments such as communications and administration, the target market is mainly electronic, mechanical, aeronautical and industrial engineers, electronic and mechanical technicians and computer scientists.

"Having to draw these people from an already undersupplied market, Houwteq is in the fortunate position of offering exceptionally challenging opportunities."

Pretoria Metal Pressing

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 12

[Article: "PMP Prepares for a New Millenium"]

[Text] In spite of recent rationalisation in the wake of the Namibian settlement, Pretoria Metal Pressings (PMP) has resolved to remain at the leading edge of ammunition production, says general manager Johan Alberts.

At the end of October last year, PMP closed most of its older plant, and in November also retrenched some of its staff following declining SADF demand for quick-fire and small arms ammunition.

PMP's origins and South African ammunition manufacture date to the 1940s when a division of the Royal Mint at Pretoria produced .303 ammunition for World War II.

Towards the end of the war most of the mint's ammunition production equipment was sold.

Says Alberts: "After declaring the republic in 1961 and the ensuing UN arms embargo, Pretoria Metal Pressings was established with the task of planning to manufacture 7,62mm ammunition of the R-1 rifle (then the FN).

"During the late-1960s, we started producing pistol and hunting ammunition. Today, we continue to maintain a leading share of the local commercial ammunition market."

PMP expanded its activities in 1972 to include the manufacture of medium-calibre, quick-fire ammunition.

In 1978, PMP became a member of the Armscor group.

Today, it produces a comprehensive range of small and medium-calibre ammunition as part of its contribution to keeping South Africa wholly self-sufficient in its armaments requirements.

Ammunition production, according to Johan Alberts, primarily involves large-scale cold-forming of metals in several stages from sheet or bar into hollow cartridges.

In the event of small-calibre ammunition, brass sheet is used. For medium-calibre products, PMP uses steel bar and aluminium alloys for the components.

Cold-forming metal is followed by precision, large-volume manufacturing, including filling with propellants and explosives, final assembly and testing.

Says Alberts: "The continued supply of acceptable-quality brass sheet for small-arms cartridge manufacture was ensured by establishing a modern casting and rolling facility capable of producing high-grade brass sheet.

"Continued sampling and analysis of incoming and processed materials, ensure the correct compositions meet military clients' stringent quality requirements.

"The rather special capability of large-volume, high-precision machining and assembly of steel and aluminium components for medium-calibre ammunition places PMP in a leading position in the precision machining field."

"In harmony with the entire Armscor superstructure, PMP is wholly committed to maintaining a stringent quality assurance programme embracing critical aspects such as material selection, machinery, processes, metrology, manpower optimisation and testing.

"Achieving and maintaining consistent high-quality outputs is a key factor for any mass-production organisation. In-process quality control-backed by a statistical approach towards quality growth and goal achievement-resulted in PMP achieving and maintaining remarkably low scrap rates and defect rates.

"PMP instils an ingrained philosophy in its people that quality originates on the shop floor.

"Quality engineering principles are applied from a product's design phase and right through to the entire industrialisation and production phases," says Alberts.

"Quality costs are monitored constantly and are an important management tool through which hidden costs related to poor quality performance receive prompt corrective action. PMP's quality costs have subsequently been reduced to levels unknown in this type of industry.

"The benefits reaped are evident in the below-average rise in product prices in spite of drastic input cost increases during recent years."

He says sustained production process improvements and optimisation have also contributed significantly to PMP's successful input cost management. Supported by its metallurgical laboratory's vast knowledge and experience and continued micrometallurgy research, PMP has also successfully optimised its cold-forming processes to the extent that intermediate annealing for reduced work-hardening has been decreased dramatically.

Turning to mateirals, Alberts adds: "The need for improved materials for more stringent ammunition performance requirements and optimised manufacturing processes compels PMP to execute a sustained materials research programme.

"These materials research activities are supplemented by well-equipped materials and chemical laboratories and experienced specialists. The laboratories also support the production plant's mateirals inspection, acceptance and analysis requirements.

"We also offer analysis and testing services to the commercial sector."

- Productivity—one of the greatest challenges that faced South African industry over the past decade, and one that is likely to receive even more dedicated focus during the 1990s—receives considerable attention at Pretoria Metal Pressings.

Says the general manager: "Productivity improvement has been the driving force behind a large number of rationalisation actions implemented in recent years. The goal has always been to minimise production input costs to ensure we deliver quality products at customer-accepted prices.

"These actions covered the entire spectrum of production inputs ranging from labour, materials and quality costs to the costs of commodities such as water and electricity. Again, the PMP productivity drive has also enabled us to rationalise costs and ensure our clients face low price increases only. In short, productivity has become a way of life here."

Occupational safety, too, receives dedicated focus. At the start of the 1980s, [passages omitted]

Lyttleton Engineering

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 12

[Article: "LEW Plays a Key Role in SA Defence"]

[Text] Lyttleton Engineering Works (LEW), as an Armscor subsidiary and main contractor in supplying weapons systems ranging from handguns to artillery systems, has played a decisive role in establishing South Africa's armaments manufacturing ability, says general manager Jan Barnard.

"LEW has established itself as a leader in the high-technology mechanical and electrical engineering industries to execute its complex task of developing products cost-effectively in the minimum time to meet South Africa's armaments requirements.

"LEW has established itself as a leader in the high-technology mechanical and electrical engineering industries to execute its complex task of developing products cost-effectively in the minimum time to meet South Africa's armaments requirements.

"LEW has established computer-assisted development, manufacturing and logistical support capabilities.

"These are backed by specialised private sector contractors who either supply LEW with raw materials and technology, or who manufacture product subsystems," explains Barnard.

He continues: "To manufacture a diverse product portfolio ranging from the R-4 rifle to sophisticated G5 and G6 artillery systems demands a high degree of technological versatility which explains why some of this technology finds its way to the commercial sector outside of the armaments industry.

"Schooled by the exacting demands set by armaments manufacturing, and faced with boycotts and the inaccessibility to international munitions technology, LEW is a dynamic enterprise and an undisputed leader in the high-precision engineering industry."

As a direct result of the arms embargo, LEW (or the Defence Ordnance Workshop as the company was known since its establishment in 1953 until 1964) progressed from a limited manufacturer of rifle spare parts, rockets and grenades to the diversified, high-technology company it is today.

In fact, one need only take a close look at the G5 and G6 artillery systems, for example, to appreciate how well and rapidly LEW has evolved over the past decade.

Not only have its powerful, precision products been well-proven in the Southern African combat zones; they have also found a lucrative market overseas where a discerning military clientele places great emphasis on cost-effective and highly reliable defence systems.

A new era in LEW's evolution was heralded in 1964 when the first completely South African-manufactured R1 rifle left the assembly line and replaced the FNFAL 7,62mm calibre rifle formerly supplied by FN of Belgium.

"After Operation Savannah in Angola in 1974/75, which clearly pointed out the deficiencies in South Africa's armaments arsenal, an impressive range of engineering achievements in the fields of product design and manufacturing technology followed, of which some were justly regarded by military experts as unparalleled in the armaments-producing countries of the world.

"The extension of South Africa's armament needs also had positive implications for the private sector as 65 percent of the value of LEW products currently originates with private contractors," says Barnard.

"The spectacular growth LEW continues to experience is the direct result of the company's ability to realise innovative engineering achievements."

He continues: "The development of the sophisticated product systems South Africa requires makes particular demands on the ingenuity and technological abilities of companies such as LEW.

"By using advanced technology for the development, industrialisation, production and logistical support, LEW ensures the weapon systems it markets comply in all respects with the strict quality and user requirements set by international military standards.

"This is achieved through the application of system engineering principles to create synergistic systems with performance far in excess of the sum of the individual components."

Turning to LEW achievements, Jan Barnard says combining client and market needs into effective products demands the successful conversion of requirements into engineering concepts.

This intricate process is initiated during the definition phase when LEW, aided by need-determining techniques, assists the client in defining the product he requires and converts the user requirements into technical terms.

Trial and error are eliminated from the development phase of new product systems by effectively using the abilities of computerised systems, resulting in significant time and money savings.

During the detailed design phases, he adds, use is made of engineering development models with attention focused on the design of sub-systems and components.

All facets of the engineering development and preproduction models are evaluated using sophisticated equipment. Adaptations are made until the produce design finally meets the user requirements.

Says Barnard: "LEW possesses an unequaled wealth of high-level expertise and can design, evaluate and produce complex products using new-generation mechanical, electrical and metallurgical engineering equipment and computer support services.

"Through continued training, LEW ensures it has a competent and dedicated personnel corps to optimally use the company's infrastructure and accumulation of high-level expertise.

"LEW has kept abreast of modern technological developments, ensuring the company remains innovative and dynamic and able to master new expertise with ease and success.

"High precision is the key concept for customised process design, machining and the metallurgical, surface and heat treatment processes of components and subsystems.

"Production methods are planned, scheduled and controlled in great detail, ensuring manufacturing adheres to prescribed tolerances regardless of production volumes. Instead of relying only on final inspection, LEW employs a statistical process control system to guarantee product quality."

He continues: "LEW's achievements throughout the years ahve not been limited to a series of technological breakthroughs.

"The company has also been effective in establishing an image as a quality-goods manufacturer. An integrated quality control system and modern quality management concepts are used to ensure all products manufactured or repaired comply with the strictest quality requirements.

"High-precision measuring and gauging equipment ensures quality standards are met.

"LEW's total approach to quality includes statistical design and execution of tests of evaluating product structure and component dynamics, stress analysis, photo-elasticity and finite element methods.

"An integrated test facility is used for simulating operational conditions in a scientific environment.

"Designers can thus determine product performance safely and cost-effectively." [passages omitted]

Institute of Marine Technology

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 13

[Article: "IMT Technology Spin-Offs Assist SAA and Diamond Mining"]

[Text] The Institute for Marine Technology (IMT)—founded at Simon's Town in 1975 by Professor Gideon de Wet—and an Armscor member for the past two-and-a-half years—is a service organisation providing professional and technical services in the maritime environment.

The IMT mission, according to general manager Pierre Louw, is: "The application and development of appropriate technologies and systems expertise in support of South Africa's maritime defence.

"Our driving force is to satisfy our client's needs for maritime technology and systems expertise effectively.

"Apart from the Navy, IMT serves other maritime industry clients needing IMT's special capabilities." The staff of about 100 members is active in: systems analysis and operations research; electro-optics; magnetics; underwater acoustics; oceanography; position fixing; and systems engineering.

Apart from the normal laboratory facilities associated with a service organisation, IMT has a facility designed to calibrate underwater acoustic/sonar transducers.

In keeping with the Armscor's evolution into new technologies, services and market segments, IMT has been broadening its commercial base to embrace non-naval research and development projects. IMT, according to Louw, was instrumental in helping South African Airways to locate the black box of its ill-fated Boeing 747, the Helderberg, off the Mauritian coast last year (1989).

IMT, using another 747 black box and a series of billiard balls (a shipment of which had been carried in the Helderberg's hull), conducted an exhaustive series of tests using a deep seawater tank and video cameras.

The data collated from these tests enabled IMT to predict scientifically how the Helderberg's black box would have sunk after the aircraft disintegrated on impact on striking the Indian Ocean.

IMT's laboratory tests more than likely saved SAA hundreds of thousands of rands in prolonged search and salvage expenses using more traditional recovery methodologies.

In another technical spin-off, IMT has assisted one of the world's leading diamond exploration companies in locating seabed diamonds off the African coast by supplying the company with adapted naval transducer technology.

Aircraft Group

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 14

[Article: "SA Stands at the Vanguard Aviation Technology"]

[Text] Southern Africa's geopolitical scenario lends itself to applying air power effectively, says Erich Esterhuyse, and Armscor aeronautical engineer and corporate spokesman for aircraft technology.

"Aircraft today enable the Defence Force to respond quickly over a long range to any threat.

"For South Africa, a small nation by population size but relatively advanced in technology and with a sound industrial base, the investment in a strong Air Force is a cost-effective approach to ensure its integrity," says Esterhuyse.

"Air power is a function of men, aircraft, weapons, ground facilities and industrial support. These elements must be integrated and fully balanced before air power can be achieved.

"In this equation, Armscor's task is to procure and supply equipment and services in support of the South African Air Force [SAAF].

"It is a challenging and demanding task which under embargo conditions requires extensive planning and the development of a balanced aeronautical industry."

He continues: "The primary strategic objective is to achieve solutions to SAAF requirements.

"Taking in account that the fly-away cost of a modern combat aircraft ranges between R60-million and R80-million and development costs several billions, the replacement of aging aircraft requires careful tailoring of programme requirements and financial constraints.

"Traditionally, we procured aircraft optimised for European conditions.

"Over the past decade the emphasis was on optimising solutions for South African requirements and many of the European requirements.

"Through these upgraded programmes the South African aviation industry grew and gained valuable experience.

"As indicated by the chief of the Air Force, the major challenge we will face in the next two decades is the replacement of the slowly-aging frontline aircraft."

Interactive planning between the SAAF and Armscor, he says, ensures a balance between user requirements,technology development and industrial development to provide effective aircraft development and support for national defence

He comments: "The rate of technology development in the aeronautical field is at such a pace that no nation can

cover the full spectrum of technologies. "Keeping abreast with developments is already a major effort and it is therefore essential that our own development programmes are focused on those programmes which will give the SAAF an edge in the battlefield or bridge specific gaps.

"Technology development activities are currently occurring on numerous technology building blocks in the areas of aircraft structures, avionics, propulsion and materials.

"To demonstrate the various building blocks' maturity level, we maintain several technology demonstrator programmes. The development of a local remotely-piloted vehicle (RPV) industry, which grew out of a technology demonstrator programme, is an example of this approach."

Esterhuyse believes South Africans have expressed a keen interest in aviation developments since John Goodman Household's first South African glider flight in 1870 in Natal.

Due to this air-mindedness, South Africa is in the fortunate position that several universities have offered aeronautical engineering courses since the early-1960s, thus ensuring a steady stream of aeronautical engineers.

He continues: "Armscor activity supports the process through bursaries and stipendia, and our technology-orientated manpower is our most valuable resource in this fast-changing environment.

"The South African aviation industry's development depends primarily on the way in which procurement and logistic activities are structured, contracted and subcontracted.

"Since aircraft programmes require considerable capital and manpower investment against the small quantities required by our Air Force, we considered pooling resources at a single, high-level prime contractor, Atlas.

"This is the most effective manner for ensuring continued technical expertise and reasonable production quantities.

"It is really only the USA and Russia who are in the fortunate position of maintaining multi-sourcing as far as their markets are concerned."

The international military aviation trend today, according to Esterhuyse, is towards greater concentration in industry through collaboration programmes for cost and production sharing.

It is the local aviation industry's goal to maintain Atlas as a flexible, high-level organisation which can adapt rapidly to changing requirements and develop a support industry in the private sector under the industrial leadership of Atlas.

Says Esterhuyse: "Recent experience indicates that even for small quantities, the South African industry can achieve competitive product prices.

"In view of aircraft programmes' scope and nature, the initiation of a new programme is a major undertaking and spaced at large time intervals. The industry can from time-to-time experience extensive increases or decreases in workload.

"To retain critical skills during slack periods the industry is actively marketing those products approved by the SAAF for export."

New aviation projects on the drawingboard and under development, he adds, will take Armscor, Atlas Aircraft and the SAAF well into the next century.

Today's design decisions are made against projections and simulations of the air combat arena of the year 2000 and beyond. "What we do know today is that avionics systems will play an ever-increasing role and will therefore require a larger percentage of the programme funding. "New-generation, multi-spectrum sensors, onboard computers and information displays have increased pilot awareness of the battlefield situation to an exceptional level. Today the technical frontier in aircraft is in the cockpit and onboard systems and not very visible to the onlooker.

"As far as the airframe and powerplant combination for new fighter aircraft is concerned, a gradual evolutionary process is being followed and the basic close-coupled canard delta configuration will be retained for many years to come.

"This is also a worldwide trend and the new fighter aircraft in the Western world are all similar in configuration," says Esterhuyse.

"Since aircraft are becoming increasingly valuable items in a defence force's inventory, they are prime targets, too. The tendency is to keep them away from enemy ground fire whenever possible. This, in turn, has led to a worldwide evolution in stand-off and precision-guided weapons.

"Due to technology and reliability improvements, the importance of air-to-air missiles is increasing again.

"The pioneering efforts of the former National Institute for Defence Research in guided missiles has ensured that South Africa today finds itself in a favourable position.

"Guided weapons and precision ammunition are such integrated components of fighter aircraft that continuous activity is required to integrate and flight-test new weapon configurations.

"This work is supported by advanced aero-elastic simulation facilities and flight test ranges."

He continues: "No other vehicle has the flexibility to deliver personnel and equipment at such a high speed as

the helicopter. The helicopter has played a decisive role in the support of the Army. Over the years, the South African industry has developed an in-depth understanding of the helicopter design, development and logistic support."

More recent helicopter programmes such as the experimental test platform, XTP-1, are laying the foundation for applying helicopters in new and improved combat support configurations.

"A new development in military aviation is the growing application of remotely piloted vehicles (RPVs).

"Development projects were launched as early as 1978 and South Africa is in the forefront of RPV technology and one of only two countries with operational experience," says Esterhuyse.

Atlas Aircraft Corporation

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 15

[Article: "Aviation Pioneer Looks Towards New Challenges: Atlas GM"]

[Text] Since the 1970s when the international community severed military equipment and technology links with South Africa, the local industry—primarily through the auspices of Atlas Aircraft Corporation—has realised and exploited tremendous opportunities for accelerating the pace of its aeronautical developments, especially in the military arena.

The formation of Atlas Aircraft Corporation in 1964 set in motion for South Africa the unenviable but rewarding challenge of developing its own aerospace industry to further enhance its internationally-recognised technological capabilities. Atlas' inception, undoubtedly, represents the most significant milestone in the country's brief but nevertheless successful aviation history.

Twenty-five years later, Armscor—primarily through the resources of Atlas and its supporting industry—has to provide a wide variety of advanced and often complex aerospace equipment and products, especially for the country's unique military aviation requirements.

In an interview at the corporation's Kempton Park headquarters, general manager Kobus Eksteen gives ENGINEERING WEEK readers some insight into Atlas's development and special features.

Explains Eksteen: "While research in support of the developing South African aerospace industry—covering all of the main aeronautical disciplines and associated technologies—is conducted in universities, national research laboratories and in industry, Atlas is responsible for bringing to fruition the concept or technology demonstrators for airframes, turbo-jet propulsion and related systems.

"The need to provide increasingly complex aerospace equipment necessitates dedicated design and development effort, and the application of substantial resources."

Recent aeronautic developments for which Atlas was the main contractor include:

- The Cheetah delta-wing fighter—an upgraded Mirage III with new flight control surfaces including canards and a totally new avionics fit;
- The Puma-based experimental test platform helicopter (XTP-1) with stub wings for external weapons and an under-slung 20mm cannon;
- And the Rooivalk combat support helicopter, a formidable force multiplier that compares favourably with the latest equipment developed in America and Russia.

Over the past two decades, Atlas' considerable manufacturing capability has also produced the impressive Impala jet trainer aircraft, turbojet engines and numerous other products, including ones for non-military customers.

It has thus developed the country's self-sufficiency to a remarkable level by international standards.

Says Eksteen: "The industrialisation of new products covers process engineering and tool design, manufacture and proving.

"With Atlas' active support and participation, specialist suppliers and subcontractors in the private sector are continuously upgrading their local capabilities to emulate the highest international standards.

"Composite materials, including glass, carbon fibres and other specialist compounds, are used increasingly by Atlas in new high-technology products for upgrading aircraft design and performance.

"Atlas, through dedicated effort, is also playing a major role as the manufacturer and supplier of spares and equipment to the South African Air Force.

"Atlas' overall maintenance and repair facilities have been established to cater for a wide range of fixed and rotary-wing aircraft, engines and associated systems and components, from the basic jet-engined trainers to supersonic military aircraft and from lightweight turbine-engined helicopters to multi-turbo-engined, heavy-lift, rotary-wing aircraft. The activity is supported by comprehensive systems test capabilities."

He adds: "As a result, South Africa is virtually self-sufficient in maintaining, overhauling and repairing its military aviation equipment, making it unique not only in Africa but in the world."

Atlas is fully accountable for assuring that quality of design, manufacture, assembly and maintenance and repair of all equipment in its inventory comply with

those standards adopted by other international aerospace industries—a task it conducts with the highest degree of professionalism.

In support of manufacture, operations and maintenance, Atlas has efficient logistics systems to meet all of its needs. Training, to meet the challenges of the corporation's full spectrum of technological activities, is an integral part of its progressive manpower development policy.

Atlas has often been cited by industry as an exemplary organisation in the field of human resources development. Of its more than 7,000 employees, there are nearly 1,000 apprentices undergoing in-house training in 14 trades in the disciplines of aircraft, electronic and mechanical systems. Specialised post-graduate training courses have been developed jointly with universities to prepare engineers for the specialised tasks.

He adds: "Technologies are being mastered progressively, while the spin-offs created are helping to develop the wider circle of South African industry, all of which make a significant contribution to the South African economy.

"Unfortunately, we face the same problem as the rest of country: the skills shortage, especially in technical areas. While we are making every effort to develop skills and to optimise resources, we cannot afford to undertake too many ambitious projects.

"Technological building blocks must therefore be developed in advance and utilised in upgrading existing aircraft, or integrated to supply a new system when the requirement materialises.

"What we have shown at Atlas—as has been done elsewhere in South African industry—is the ability to adapt well to our circumstances while providing products to international standards.

"This is particularly challenging for a South African organisation. What is often not appreciated is that Southern African conditions are far more rugged than those of Europe.

"Helicopter engines, for example, don't enjoy the same longevity as their European counterparts.

"We can expect to see major advances in the field of materials—not only to promote longevity and performance but also costs. We have been working closely with CSIR [Council for Scientific and Industrial Research]'s Division of Materials Science and Technology in this regard."

As for a dominant challenge in Atlas's management, he foresees a sustained effort to rationalise every manufacturing cost possible while maintaining a strong foothold at the vanguard of aeronautical technology and being able to develop cost-effective and appropriate combat aircraft for national defence.

Turning to future prospects, he adds: "There is a big future on the aircraft maintenance and support side, whether military or civil, national or international. We will also be establishing new development and manufacturing programmes—primarily to extend an aircrafts design life and capability while retaining flexibility to expand such programmes for supplying a complete aircraft system when the need arises.

"The challenge will be to stabilise the organisation beyond military and political factors. We will be looking more keenly at international opportunities where we feel we can compete well on basis of price and quality."

Systems Engineering

34000458A Johannesburg ENGINEERING WEEK in English 1989 pp 15-16

[Article: "Aerospace—the Drive Behind System Engineering"]

[Text] This article illuminates the aerospace system engineering concept, its elements and their interrelationships so personnel engaged in design and project management activities may understand them and appreciate their worth in any system design and procurement programme.

An emotive event in America a few years ago illustrates the dramatic rate of progress achieved in aerospace technology: an aged gentleman, who was a mechanic working with the Wright brothers at the time of their historic first flight, met and shook hands with Neil Armstrong, the first man to walk on the moon.

The associated technologies have grown exponentially—the first aeroplanes were often designed, built and flown by one man in a matter of weeks; a small team of engineers, draughtsmen, and artisans in 1940 rolled out the prototype North American P-51 Mustang fighter aircraft only 117 days after commencing the design. In contrast, the development of a fighter aircraft today, measured from start to first flight, is typically several years—and involves thousands of skilled people.

There are two reasons for this exponential growth in the development programme durations. Firstly, the technical complexity of aircraft has increased, particularly after World War Two.

Secondly, this complexity has engendered a high degree of engineering specialisation. Whereas, before the war, engineers worked within the broad disciplines of aeronautical, mechanical, electrical and industrial engineering, the development of complex aircraft dictated further specialisation, giving rise to an additional split of engineering along highly specialised lines. The aeronautical industry now has engineers for reliability, maintainability, quality assurance, human factors, safety, environmental, configuration and many other specialised disciplines.

Unfortunately, increased specialisation brought its own management problems; just how was control and integration of all these engineering specialities to be ensured, particularly with large development teams and the need to co-ordinate the activities of hundreds of sub-contractors?

To ensure proper communication, co-ordination, direction and control of the activities of all of these diverse disciplines, yet another speciality—system engineering—was originated to function as a co-ordinating discipline for all the other specialist disciplines.

Experience has shown that the concept of the system approach—the application of system engineering—is, in general, grossly misunderstood by technical personnel.

In an endeavour to formulate a formal approach to system design, a study of various successful design programmes in the post-War period reveals that, although no two systems are ever designed the same way, a common pattern exists. It comprises nine phases:

- description of system mission requirements;
- establishment of required system functions;
- trade-off studies between alternative design options;
- synthesis of a suitable system;
- definition of the system in the form of unambiguous specifications;
- system and subsystem design (generation of hardware);
- system performance evaluation (testing & qualification);
- system production; and
- sustaining engineering (in-service support).

Aircraft programmes have clearly shown that the most crucial phase of the entire sequence of activities is transforming a mission requirement into a comprehensive system specification and description of the preferred system configuration. Such specifications provide the designers with a suitable framework to which their designs should conform. Sufficiently detailed specifications ensure all facets of the ultimate design—e.g. structural, mechanical, electronic and human factors—are compatible, and that individual designers expend their efforts in the most fruitful directions. Thus the system engineering process was devised as a logically organised, sequential approach which converts in-put requirements—based on user needs—into a description of the proposed system and its elements.

System engineering has grown as a discipline since World War Two. A large portfolio of tools, processes and specialised software have been developed over the years to help the system engineer to define and understand requirements, configure and size the system, manage its development and to verify the capability of the design. To attempt to provide a working familiarity with the theory and applicaiton of system engineering and its techniques and tools within the confines of this article would be folly.

Thus, the entire system engineering process model (whereby system engineering methodologies and techniques can be applied to derive a coherent design) has been condensed into the chart shown. This chart presents all the parameters to be considered in system design. System engineering must determine which specific parameters are applicable to their particular system design problem.

The chart also illustrates the key principle that all decisions made in arriving at a system design and then accomplishing the engineering effort required to translate the design into equipment, facilities, procedures, trained personnel and logistics support must always be tested by referral back to the specified user requirements.

The system engineering process comprises a systematic method of designing systems. Unfortunately, because it is a relatively new concept in South Africa, its power and value is not fully appreciated, and opinions about its usefulness vary from the intense belief that it is sheer magic to the conviction that it is nothing more than the logical application of common sense.

The system engineering process is not a magic formula guaranteeing a 100 percent success rate in designing systems. But nor is it merely the application of pure common sense. It is a well-structured procedure to maximise the probability of a successful system being designed while minimising the possibility of important factors being overlooked.

Systems engineering has become a powerful tool—used primarily by the aircraft industry—to translate a user requirement into mission-effective hardware. The usefulness and importance of applying the process can best be assessed by considering the consequences of not following the approach.

If the system design approach is not systematic, a situation tending towards chaos will result, leading to increased development costs, decreased system performance, slipped time-scales, even accidents and, perhaps, loss of life. This last consequence is not intended to be over-dramatic as illustrated by the following example.

A dramatic and tragic case of failure to observe the system engineering approach in the development of a highly complex system is the launch-pad fire in the Apollo spacecraft command module in January 1967. Due to political pressures to get the Apollo system operational on schedule, a serious breakdown in engineering communication occurred.

As a result, certain interacting factors were overlooked: the on-board electrical system was designed so that electric arcing was possible; the life-support system made provision for an all-oxygen atmosphere within the capsule; electrical insulation was known to exhibit enhanced flammability in oxygen atmospheres; space suits afforded no protection against fire; the capsule's escape hatch was designed so that egress was both difficult and time-consuming.

The fire in the capsule during training resulted not only in the death of three highly trained and experienced astronauts but also a year's delay in the Apollo manned flight programme because of lengthy investigations and expensive redesign programmes.

Prevention of accidents such as this require no great advances in science or technology—merely greater attention to the interactions (and their consequences) between the various sub-systems collectively forming the total system. The systems engineering process, developed in response to the needs of aerospace industry, offers a formal method whereby this required attention can be assured, and whereby safe, reliable, supportable, operable and effective systems can be developed.

Milistan Facility

34000458A Johannesburg ENGINEERING WEEK in English 1989 pp 19, 29

[Article: "Scientific Decision-Making Support"]

[Text] The success of a sophisticated armaments industry today depends not only on state-of-the-art designs, production, testing and quality skills and methodologies, but also on the implementation and evolution of advanced theoretical models.

Hence the formation of the specialist Armscor facility, Milistan, under the leadership of mechanical engineer Dr Andre Buys.

Milistan—an acronym for "military systems analysis"—is not a production unit. Instead, it is committed to "playing" sophisticated war games, many of which are projected well into the 21st century.

Imagine trying to envisage realistically a combat zone in 20, 50 or even 100 years time!

How will wars—if deemed "necessary"—be fought?

What tactics, strategies and weapon systems will be used by the enemy and how should these be counteracted by the SADF? What impact should likely future scenarios have on today's design and development of armaments and associated support systems for the military?

These broad questions are addressed in great depth and scope by Milistan, using its synergistic force of manifold scientific and technical skills in collaboration with data and prognoses supplied by the SADF.

Milistan is one of those specialised institutions where mathematics is an indispensable are and science.

Explains Dr Andre Buys: "We're involved in operations research and system analysis and model mathematically a wide variety of systems.

"The origins of this field of activity data back principally to World War Two with the innovation of mathematically-inspired decision-making support.

"The thinking was that the same scientific and mathematical methodologies that led to development of such technologies as radar might be applicable to the analysis of operational problems.

"The skilled application of natural sciences in military technology fields posed a great challenge for those countries and organisations in search of superior defence systems.

"South Africa, through the auspices of Armscor, is no exception.

"We have seen the impact of operations research on commercial businesses since about the 1960s in areas such as production processes. Operations research is complemented by the management of science.

"Operations research has a lot to do with a system—analysing it and trying to model it by creating a conceptual model of a real world situation. "Experiments have to be conducted in a highly disciplined fashion to determine what type of decisions have to be made in specifying, designing, developing, producing, using and supporting equipment for combat situations.

"Determining how these processes should be managed and the important human elements to consider are critical to our exercises."

He continues: "In South Africa, military research started in earnest in the early 1970s when the Defence Force became acutely aware of the need for more scientific support.

"Work in this area started at the SADF Directorate for Information and Systems Analysis but many specialist disciplines were needed in a structured system to produce the most fruitful results, hence the SADF overtures to the old Armaments Board and the eventual conception of Milistan for scientific decision-making support.

"Milistan's work has made a significant contribution to SADF decision-making in a wide variety of fields. We have cultivated close ties with the SADF and have a more 'proactive' (rather than reactive) role to ensure we respond to Defence Force needs in the most optimum manner possible.

"If, for example, the SADF client cannot specify his weapons system needs sufficiently, we play an instrumental role in helping the client to determine his needs and to transform these into satisfactory requirement specifications."

Milistan, according to Buys, supports Armscor by providing the right support and information in critical areas such as systems quality assurance and integrating client needs nd specifications into an holistic solution for maximum benefit on the battlefield.

At the highest level of military planning (level eight in terms of the Armscor-SADF methodology), Milistan has to determine what future environments will be like and,

in effect, bridges the gap between strategic military planning and the more purist disciplines of scientific academia.

Thinking has to be permeated with cost-effectiveness to ensure that "the most is created using the least" (as with the entire Armscor's culture).

Extensive use is made of the facility's sophisticated database that has been expanded in recent years as both SADF and Armscor organisations are able to acquire and collate more meaningful statistical information relating to military exercises, equipment and trends in general.

Database specifics are ideal for addressing crucial elements such as how much and what type of ammunition is required of a particular military manoeuvre and how these consumables need to be sourced, transported and secured, for example.

The idea behind such an example is to ensure SADF units are adequately equipped for likely confrontations without the risks of expending all their consumables and without the burden of being overstocked.

A dash of imagination helps the more technically inclined person to appreciate the implications of such an example in all vital areas of modern warfare—areas such as vehicles, personnel, rations, communication and essential support services (e.g. medical services).

Of Milistan's 85-strong staff compliment, about 55 are specialist scientists, technicians and engineers covering disciplines such as statistics and data analysis, computer modelling, physics, mechanical engineering, ergonomics and chemistry.

Milistan's growth, he says, has been "strident" and will continue with the staff compliment likely to reach 100 as SADF requirements become more sophisticated.

Adds Buys: "War is a complicated business especially if you are trying to model what's happening on the battlefield—and even more so if you want to be realistic in your prognoses and decision-making support.

"A sophisticated war game can take two to three years to design.

"But we have also evolved the resources to respond urgently to defence requirements, depending on the end-need's degree of sophistication."

Milistan—having done some work for critical national needs in other industries such as the agricultural and automotive sectors—foresees itself making a greater impact on industry in general and the national quality of life.

Swartklip Products

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 20

[Article: "High-Tech Pyrotechnics"]

[Text] Over 40 years, Swartklip Products has evolved from a commercial fireworks producer into a fully-fledged Armscor subsidiary making a diverse range of state-of-the-art pyrotechnical products and ammunition for the South African and export markets.

Led by general manager Willie van Zyl, an industrial chemist who has been with the company for 26 years, Swartklip is a medium-sized research, development and production company located about 25 kilometres from Cape Town on the Cape Flats.

It was founded in 1948 as Rondens Manufacturing Company and became the country's foremost fireworks producer during its first 20 years.

Because the demand for fireworks was seasonal, the company broadened its product range to include detonators for the Railways, emergency flares for the marine industry and various pyrotechnics for the SADF.

In 1966, the first local shotgun cartridges and .22 rimfire ammunition were manufactured by the organisation.

Since its acquisition by the Armscor forerunner in 1971, Swartklip Products was developed systematically from a pioneering venture into a specialist high-technology operation geared to meet local demands and to replace imports.

According to Willie van Zyl and his management team, new systems of management, production and distribution were introduced, research and development was given a pivotal role and quality standards were adopted and nurtured to emulate some of the highest in the world.

Explains Van Zyl: "In accordance with the Armscor group policy that the private sector should be employed to the maximum, Swartklip began establishing a network of suppliers in the Western Cape and developing mutually advantageous relationships with a broader spectrum of local industry.

"At the same time, to supplement the company's research activities, research institutions and universities were involved in specific projects and programmes for new product development and import replacement.

"Today, the company is recognised as a leader in the pyrotechnics field, a position that has resulted from its policy of investing substantially in plant, equipment and people.

"Management believes the company's prime asset is its workforce. Consequently, training is given top priority and every possible measure is taken to afford personnel the opportunity of realising their career aspirations within the company or Armscor."

"As a result of the international arms embargo in 1977," Van Zyl says, "the company was faced with the responsibility of providing items and technologies which could no longer be imported.

"Although the research and development activities were continuous and crucial to the company's future, a new sense of urgency was introduced for the replacement of existing products and the development of new products to keep pace with world developments.

"Some of the products developed and manufactured on our premises are now used in numerous countries throughout the world and are in high demand for their special features and capabilities.

"Typical examples include: rifle and hand grenades; red phosphorous smoke technology; radar screening devices; 155 millimetre shell cargo rounds; infra-red technology; anti-riot items; and 40 millimetre cartridges."

Swartklip's commercial products, he says, are manufactured to the same stringent quality standards as the military ones.

Virtually all products were developed originally for military applications and then adapted for commercial use, or vice versa.

The company's commercial products include: distress rockets for ships; mini-flares for anglers, divers and sailors; buoyant marine distress smoke signals; railway detonators; shotgun and .22 ammunition; industrial blanks for the construction industry; cartridges for rock-breaking equipment; and cartridges for kiln and furnace descaling guns.

"Because the armaments industry is so competitive, we are constantly improving products and developing new-generation ones.

"Whereas the company formerly manufactured individual items only, it now also undertakes the design, development and production of several complete weapon systems," says Van Zyl.

"New products are specified and developed in full consultation with the client.

"The user's operational requirements are converted into technical specifications and then development proceeds according to these specifications.

"Development is conducted on a multi-disciplinary basis with physical and chemical scientists working in close collaboration with engineering colleagues. Solutions to problems must be economical, realistic and practicable.

"Where necessary, the assistance of other research institutions is enlisted and overseas sources are consulted where local expertise is not available."

Computer-assisted modelling is used to obtain optimum designs which, in turn, are subjected to the most stringent laboratory and field tests during the development phase.

Simultaneously, all raw materials are analysed stringently in the process and chemical laboratories to assess their suitability for particular applications.

Manufacturing specifications are made during the final development phase and once the product and process have been qualified, production commences.

Comments Van Zyl: "The involvement of our suppliers at every stage—from development to series production—is crucial for the success of the total engineering programme.

"New developments in the armaments industry frequently require the use of special mateirals, equipment and processes.

"Restrictions and sanctions often require replacement materials to be developed or processes to be established to provide an essential material for which there may be no suitable substitute.

"These conditions apply especially to the pyrotechnic industry where the purity and form of chemicals and other raw mateirals are extremely important to obtaining repeatable performance characteristics.

"Upgrading and developing products often involves close co-operation between suppliers and the company in designing and developing suitable manufacturing processes for components. For example, the use of aluminium for making various rockets and cartridge cases.

"For these items, impact extrusions and deep draws of small cross-sections are required to extremely close tolerances.

"These requirements have involved close cooperation between the raw material suppliers, component manufacturer and the company staff to evolve satisfactory designs for the process tooling and equipment to produce acceptable components."

The ultimate objective of Swartklip's management, he says, is not only technical supremacy but also excellence in any project undertaken. This philosophy is the foundation of the company's success.

Explains Van Zyl: "All products are characterised by purposeful design and appropriate manufacturing processes to set specifications. To comply with stringent international military specifications, we have a demanding integrated system of quality control and assurance.

"Quality marks the entire cycle—right through to the final product which is supported throughout its life cycle.

"All raw materials are laboratory-tested to ensure they meet our complete requirements. All components supplied by subcontractors are manufactured under process-controlled conditions.

"Gauges and measuring instruments are calibrated in our CSIR [Council for Scientific and Industrial Research]-approved metrology laboratory.

"This valuable service is offered to our subcontractors and other companies. In addition, samples of the various components supplied by our subcontractors are laboratory-checked for dimensional conformity."

Management according to Van Zyl, regards employee welfare and safety as its prime responsibility.

This commitment is demonstrated by its long and successful association with NOSA, the extremely few injuries and its comprehensive welfare services which place it among the leaders in occupational health care in the Western Cape.

Somchem Subsidiary

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 20

[Article: "Successful Valkiri Artillery System"]

[Text] Armscor subsidiary Somchem—renowned for developing and manufacturing missiles, grenades and other defence consumables and systems—added another "feather to its cap" in the 1980s with the successful launch of the motorised Valkiri artillery system.

Somchem supplies products to the SADF directly, other Armscor subsidiaries and to export customers. Based in the Western Cape, it has three facilities: the Somerset West and Kranzkop factories, as well as a testing facility near Hangklip.

A company spokesman said Somchem acts as the main contractor for he group in providing:

- military explosives and filling materials for bombs, missiles and grenades;
- propelling media for small arms and rapid-fire ammunition, mortars, rockets and missiles;
- propelling agents for loose-loading gun ammunition (140mm and 155mm); and
- complete rocket armament systems.

Somchem is also a subcontractor in the short-batch production of missiles, ballistic sub-systems, motors, warheads and security armament mechanisms. It is responsible for providing combustible shells, as well as explosive intermediate products required for manufacturing driving agents and explosives.

It has established development and manufacturing capacities covering all types of propelling agents as well as rocket sub-systems and systems to maintain its continuous lead in the armaments industry. The company has been focusing on (and will continue to do so) expanding modern production and research facilities to ensure its foothold at the forefront of specialised armament-related technologies.

High demands are placed on the company for generating expertise and knowledge internally for optimal self-sufficiency. This also forms the basis of Somchem's export achievements as a result of the high risks associated with the armaments industry.

Therefore, successful safety and loss control programmes assist the organisation in achieving its ideals and sound company culture.

Somchem's main objectives are the pursuit of:

- discipline and consistency;
- excellence and consumer satisfaction;
- effective personal communication and involvement.

The formidable Valkiri, Somchem's multiple artillery rocket system, has been proven more than amply in battle since its official launch in early 1981 after four years of thorough development and refinement.

"The typical scenario of the 1980s' conflicts can be summarised as a series of varied targets spread over a large area and requiring accurate and intensive bombing in a short time period for optimal exploitation of surprise effect," said the spokesman.

These circumstances require an armaments system combining cost-effectiveness with the following operational requirements: high fire volume in the shortest possible time; extremely high mobility; applicaiton against various target types; optimum lethality; and superior accuracy.

Since its launch, the Valkiri has been known as a "phenomenon" for SADF artillery soldiers and it is reputed to be much-feared by the enemy.

The Valkiri's origins date back to the Angolan War of 1975. One of the enemy's arms systems threatening South African forces at that stage (and for which the Valkiri system was needed) was the Russian-made BM21 multiple artillery rocket system, also known as the Stalin Organ. The Valkiri, once unveiled in the field during Operation Protea, soon displayed its supremacy over the Russian BM21.

The Valkiri system has a 127mm artillery rocket system comprising double-based driving agent rocket motor and a pre-fragmentation warhead on to which a contact action or proximity action tube can be fitted. The rockets are fired from a self-propelled mobile launcher. Main elements include the mobile launcher, ammunition vehicle, rocket with warhead and tube, fire control and support vehicle, and meteorological and surveying equipment.

In the field, the Valkiri—with its saturation armament system firing—can be deployed as a single firing unit in batteries or with more conventional artillery against area targets such as camps, troop concentrations, soft-skinned convoys and logistical installations.

The Valkiri fulfils its battle role by concentrating its high-density saturation fire during a short period on the target. Within 23 seconds, a battery of eight launchers can fire 192 rockets over a distance of up to 22km. Because of its high mobility, it is especially suitable for the "fire and run" operational modes where swift deployment and firing is followed immediately by withdrawal to avoid tracing and counter-bombardment.

Gennan Systems

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 21

[Article: "Gennan: Ensuring Systems Integrity"]

[Text] Specialist Armscor facility Gennan Systems is a system house devoted to developing system specifications for vehicle-based ballistic systems, according to facility manager Dr Dave Wimpey.

The facility, for example, was responsible for developing the final specifications for the Rooikat armoured car's firing power, mobility and ballistics performance requirements, as well as the reliability, maintainability and logistic support requirements.

"In essence, we are a team of dedicated specialists who ensure a system's technical integrity. We are instrumental in ensuring the clients needs and specifications are met in terms of technical design and performance.

"Going beyond mere specifications, our role is realised in determining the most pragmatic and cost effective way of integrating a system's components such as the weapon, ammunition round, fire control system and vehicle platform. Entire systems are designed and then broken down into their component sections for further design, development and refinement before evaluating the system's design and performance as an integrated final system."

This systems house approach, he said, entails considerable theoretical analysis to ensure all practical work meets whatever criteria and standards have been set with the least waste of time, materials and other valuable resources.

"Science and technology today allow a specialist team such as Gennan Systems to determine accurately how a vehicle, for example, will perform on sand or clay ground before it is built. Such is the degree of sophistication involved today in using computer models and databases for theoretical design and design analysis.

"When starting a project with a client such as the Army, we have to consider the type of environment in which a vehicle will operate as well as its tactical mobility, reaction time to engage a target, accuracy of its weapon system, vulnerability and a host of other factors, including known and potential threats from enemy or possible enemy forces.

"These needs, when established properly, can be translated into precise engineering terms to ensure, ultimately, that theoretical specs can be met reliably and consistently in the field."

The Gennan Systems multi-disciplinary team uses the highest engineering and technical standards available such as those prescribed by the SABS (Bureau of Standards) and the European Economic Community to ensure the highest possible engineering standards in line with stringent Armscor corporate quality assurances practices.

Gennan Systems' specialist work extends as far as evaluating likely future trends and requirements.

Naschem Subsidiary

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 22

[Article: "From Bomb-Filling to Advanced R&D"]

[Text] In less than a decade, specialist Armscor subsidiary Naschem has evolved from being little more than a bomb and mortar-filling factory into a fully-fledged ammunitions research, development and implementation organisation with a multi-million rand investment in sophisticated technologies and human resource development programmes.

Secluded in the south-western Transvaal near Potchefstroom, Naschem today manufactures and supplies medium and heavy-calibre ammunition and ammunition systems including:

- all gun-fired ammunition from 40mm calibre upwards;
- a variety of aircraft bombs;
- naval gun-fired ammunition;
- gun-fired armour ammunition;
- mortars and infantry sub-systems; and
- mines; demolition charges and detonics.

Naschem started in 1968 shortly after the UN Resolution 418, the first armaments boycott against South Africa, when the then Defence Procurement Committee assumed technical responsibility of the AECI ammunition factory at Lenz, near Johannesburg.

The former AECI facility—closed recently in line with a corporate rationalisation programme-produced a staggering 28,5 million ammunition items during World War Two. Naschem was officially named on August 1, 1971.

This subsidiary commenced as a filling and assembly plant, using components procured mainly by the then Armaments Board from a variety of overseas licensors. These sources, however, were soon closed and from the mid-1970s, Naschem began assuming technical responsibility for its own products.

This entailed acquiring the design responsibility, the philosophy of which was completely unknown, and establishing a variety of private industries to manufacture the components locally.

The new Naschem challenge also entailed establishing facilities for research and development, detonics manufacture, and modelling and design. A project management capability also had to be established to ensure timeous project execution as well as enhanced manufacturing capabilities and quality assurance.

This all had to be executed against a growing SADF demand for armaments.

General manager Teuns Keuzenkamp commented: "Today, Naschem can look back on the successful execution of these tasks. It has, in fact, surpassed its original task by far in establishing several major milestones."

Theses include:

1. A development capability which has introduced a variety of locally designed and developed items used by the SADF, private industry and in overseas countries. These include:

- the renowned CB470 cluster bomb that was awarded special recognition by Armscor's chairman;
- The G5/G6 155mm ammunition, a world leader with its pin-point accuracy and 40km range;
- the improved conventional 155mm round, a cluster round with 56 submunitions each with an anti-personnel and anti-hard-target capability;
- the improved conventional 76mm naval round (for defence against sea-skimming missiles and aircraft) with a lethality factor 30 times larger than its conventional predecessor;
- The Rooikat's highly explosive armour-piercing ammunition rounds for which Naschem received the Armscor Chairman's Award as well as a commendation from the chief of the SADF;
- prefragmented 120kg and 250kg aircraft bombs for a substantially improved Air Force strike power (another development that resulted in a commendation from the chief of the SADF);
- a special charge developed for the mining industry to clear blocked ore passes—this item has already saved millions of rands in lost mining production.

2. All of these developments would have been impossible or at least highly non-cost-justifiable without Naschem's advanced modelling and design capability. Over the past decade, this capability has evolved to include an impressive inventory:

- a powerful scientific computer, with support infrastructure and trained personnel, to simulate the effects of changing design parameters for a product's performances (this leads to a far more efficient design optimising method than the traditional trial-and-error proofing methods, and provides accurate forecasts of detonation events);
- implementation of a sophisticated three-dimensional computer-aided design (CAD) for effective design support to design engineers;
- establishment of many advanced computer models and hydrocodes, particularly in the field of ballistics, and submunition parameters;

3. A filling and assembly plant at Boskop near Potchefstroom. This plant is believed to be among the world's most advanced ammunition facilities with its sophisticated surface-treatment processes, highly automated and computer-controlled filling and assembly lines, and high-standard quality assurance.

4. An invaluable test and evaluation range at Boskop with sophisticated metrology equipment to ensure precise development work.

5. Excellent private industry contractors for component manufacture and specialised development work.

6. A well-equipped research laboratory, concentrating particularly in the fields of detonics, and primary and secondary explosives. Technologies include scanning electron microscopy, X-ray fluorescence and diffraction spectroscopy, differential thermal analysis, thermogravimetric analysis, bomb calorimetric analysis and particle-size distribution analysis.

7. An advanced detonics laboratory featuring flash X-ray analysis and ultra-high-speed photography (up to 20-million frames/second) for recording detonation phenomena.

Said Keuzenkamp: "In executing its task to satisfy user requirements, Naschem has adopted a 'cradle to grave' approach. This means that operational requirements, whether military or commercial, are satisfied by the systematic execution of defined phases, thereby eliminating uncertainties and risks. The resultant products are supported during their total life-span.

"Any operational requirement is followed by a conceptualisation phase to generate and optimise different concepts for requirement satisfaction. This phase is followed by defining the most optimum solution to the problem.

"A full-scale development phase is then pursued during which the definition is transcribed into engineering terms and results in final designs being generated through a process of interactive design and evaluation."

He added: "Having finalised the designs, an industrialisation phase commences during which manufacturing processes are established with the controls for successful production.

"After qualifying the various processes, serious manufacture commences and the product is supported for its entire life cycle.

"The total execution of any development action rests with the project manager. He is accountable for co-ordinating all project aspects, including work breakdown structures, planning, works authorisations, control, corrective actions, financial control, technical performance measurement, configuration management and quality assurance.

"In short, the project manager is the single point of integrated responsibility."

While Keuzenkamp and his technical team acknowledge their wealth of resources, they are also well-aware of certain shortcomings. It is company policy not to duplicate expertise available in the private sector, but to rather subcontract tasks to the organisations best-equipped for the job.

Said Keuzenkanp: "For this reason, many development companies are contracted for tasks like electronic fusing systems, seekers, guidance systems and other highly complex electronic sub-systems.

"It should also be emphasised that Naschem does not manufacture any hardware for its products. About 80 South African private contractors manufacture the various components using Naschem designs. This is in line with the corporate policy of optimising private sector resources for armaments manufacture."

To ensure appropriate technologies are always available, Naschem has established a discipline to identify future technology needs and to ensure these technologies will be available when needed.

Naschem adheres to the stringent corporate quality assurance principles—right from elementary design and feasibility work through to client support.

Further, the organisation also maintains a strict safety and loss control programme which has resulted in a particularly low loss of man hours.

In line with corporate environmental policy, Naschem also has an active environmental management programme which, among other tasks, oversees the protection of more than 660 head of game, including a wide variety of buck.

Contrary to some public misconception, Keuzenkamp emphasises, Naschem is wholly committed to ensuring its research and development work has no negative impact on its almost pristine Boskop site.

Gerotek Test Facilities

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 23

[Article: "Pre-Combat Testing Is Essential"]

[Text] Superior military strength and strategies depend largely on the successful application of superior technologies that have been amply evaluated using advanced scientific and engineering test facilities.

Hence the existence of the specialist Armscor facility, Gerotek Test Facilities, led by facility manager Henk Snyman, who outlined Gerotek's roles and nature succinctly in an ENGINEERING WEEK interview.

Comments Henk Snyman: "Armscor is dedicated to supplying highly reliable yet economically competitive products for modern technology defence applications.

"The ability to assure the user of dependable equipment in critical combat conditions is enhanced considerably through pre-combat qualification prior to user acceptance.

"Armscor's policy of totally integrating expertise with the private sector has led to quality engineering also being made available to the private sector in the interest of South African industry at large.

"Gerotek Test Facilities is instrumental in fulfilling this qualification role by objectively verifying and evaluating a product's performance.

"This design audit is conducted under simulated and controlled conditions in which the equipment would be required to operate adequately.

"Once qualified, a product's potential for introduction into a competitive world market is increased significantly."

Gerotek comprises three divisions specialising, respectively, in environmental, vehicle and ballistic testing.

The environmental test facility at Verwoerdburg is a product qualification authority. Equipment performance is verified and evaluated in realistically simulated and controlled environments.

According to Snyman, an objective design audit is effective in identifying latent design and production-related defects which may not be evident during normal operation.

They may, however, be encountered during the equipment's life cycle under harsh environmental conditions in which the equipment may be required to operate.

Says Snyman: "Quality is engineered into integrated systems by the environmental test facility, having been qualified from a sub-system level.

"The level of confidence in the systems reliability is hereby enhanced. As a qualification authority, experience at the facility has been derived from the critical appraisal of numerous products now in operation.

"This objective assessment, initiated from design concept, is applied through the various stages of engineering design and development and during the product's life cycle."

He continues: "Gerotek supports design for reliable system operation as an integral part of the design process."

The various predictive and analytical techniques applied provide a means of identifying and analysing problematic areas in a design—those problem areas often not immediately evident from, or economically realisable, through mere acceptance testing.

"Worst case analysis on electronic circuits is a design assurance responsibility and an extension of classical circuit analysis.

"An electronic circuit's performance attributes are evaluated against specified tolerance limits under the simultaneous variation of operating conditions. "Resilience against component parameter tolerance variation as well as chronological and environmental (temperature and electro-magnetic radiation) induced drift may subsequently be designed into hardware.

"A system's reliability and availability are optimised by the risk analyses performed by design assurance.

"Reliability modelling and predictions of failure modes and the severity thereof, are supported by guidelines to enhance a design's integrity."

The reliability engineering activities performed by design assurance, explains Snyman, are extended in the environmental simulation laboratory where automatic test equipment (ATE) is used to perform reliability demonstrations and reliability growth programmes.

The expertise is available to generate these programmes and analyse resulting data for further appraisal of failure rates.

"Mechanical design assurance at Gerotek is offered through modal analysis—the complex field of structural dynamics.

"The structural response to excitation is characterised in terms of theoretical resonant frequencies, damping and mode shapes to ultimately optimise structural modifications.

"A theoretical fatigue life prediction system provides the section with a scientific base from which accelerated life testing can be prescribed or the servo-hydraulic dynamic strength tester," he says.

Shock, vibration and fatigue testing are complemented by these analytical capabilities.

"Environmental screening of electronic and electrical components for qualification is often executed through a mechanical interface. "Extensive experience has been gained in simulating practically acquired shock and vibration data.

"Environmental stress conditions are imposed to accelerate failure that would normally be encountered later in the product's life cycle. Environmental stress factors also include simultaneous temperature and vibration as well as pressure, humidity, salt spray, ultra-violet radiation and dust—severe yet realistic conditions in which a product's adequacy for operation in its intended environment is determined.

"Gerotek's environmental simulation laboratory has the ability to cycle combinations of the environmental extremes.

"Reliable operation in the electromagnetic environment provides another complex dimension to the product acceptance process.

"The vulnerability of equipment to electromagnetic radiation—conducted or radiated, and leading to malfunction—has potentially severe consequences.

"Conversely, the implications of interference generated, adversely affecting adjacent equipment is equally problematic."

Snyman continues: "The electromagnetic compatibility (EMC) or harmonious operation of components, operating in close proximity and comprising a system, is evaluated by electromagnetic effects engineering.

"This section supports design for EMC. Consultation is offered on the implementation of interference control techniques from design concept to final sub-system and system integration.

"Inter- and intra-system compatibility is assured through EMC control/test planning and specification compliance evaluation."

As a product qualification authority, Gerotek offers complete theoretical and practical design audit expertise.

Calculated engineering judgment from experience in quality assurance forms the basis of suggested remedial guidelines where problems or failure to meet specification compliance has been encountered, he says.

Gerotek Ballistic Testing's range in the Northern Cape provides the complete infrastructure for a safe and particularly suitable environment for conducting comprehensive weapon tests and evaluations.

A client's needs are met by test planning, compiling the test instruction, instrumentation and telemetry, actual test conducting, and data acquisition and processing.

Gerotek Vehicle Testing at Pretoria West was established to satisfy an urgent need for an ill-encompassing test facility at which vehicle design and development could be evaluated in a typical South African environment.

The testing facility, closely emulating field operating conditions, allows accelerated and repeatable tests to be performed in an objective and reliable manner.

Vehicle, evaluated in the standardised road and track infrastructure, are exposed to environmental extremities peculiar to local climatic conditions.

Comments Snyman: "Vehicle Testing, apart from providing a wide range of facilities to test virtually every conceivable vehicle function and capability, accommodates research and development projects.

"A fully equipped workshop and instrumentation are provided for data acquisition and processing as well as logistic support.

"Vehicle structures and their dynamic performance, mobility and endurance form an integral part of the evaluation and analytical service offered to automotive designers and manufacturers.

"Interaction between sub-systems, including the complete electrical system, also forms part of the evaluation.

"Thermodynamics, electromagnetic compatibility as well as ergonomics are studies complementing Gerotek's capabilities in vehicle testing."

He adds: "The three Gerotek facilities as a whole have the mandate to offer a comprehensive system evaluation and verification service to the country's high-tech product designers and manufacturers.

"A product's adequacy and integrity are enhanced significantly through the qualification process offered by Gerotek Test Facilities."

Overberg Test Range

34000458A Johannesburg ENGINEERING WEEK in English 1989 pp 24-25

[Article: "OTR: Pioneering New Standards"]

[Text] On the borders of De Hoop National Park near the southern-most tip of Africa lies one of the world's most impressive and sophisticated open-air laboratories—the Overberg Test Range (OTR), one of Armscor's newer subsidiaries.

Sprawling next to the picturesque fishing village of Arniston, OTR is responsible for establishing, maintaining and developing facilities to satisfy the defence community's in-flight missile test and evaluation requirements using sophisticated equipment and systems.

Led by general manager, Dr J. G. Malan, a nuclear physicist by training, OTR's clients are mostly developers requiring accurate, state-of-the-art engineering performance data for improving simulation models, and developing and qualifying weapon systems.

In an interview with ENGINEERING WEEK, Dr Malan outlines the background to Overberg Test Range's development and objectives.

"The facility's planning goes back to 1981 when it became evident that as the sophistication of Armscor's weapon systems increased, a high-technology facility was needed to match this sophistication.

"Today, Overberg has the ability to manage and execute all flight tests, thereby forming an important supporting link in the country's armaments industry.

"Overberg differs from similar facilities elsewhere, which evolved over a longer period, in that it was planned and developed as an integrated unit to allow multi-purpose application of capabilities.

"The Overberg facilities' modular composition and their ability to reconfigure swiftly—supported by an established infrastructure—enables clients to conduct in-flight tests which would have been little more than dreams a decade ago.

"Any combination of air, ground and sea tests can be executed, allowing OTR to test the most sophisticated and intelligent armaments such as Armscor's latest generation of missiles and guided weapons."

He continues: "During the development of a new missile or weapon system, a wide range of tests is done to prove simulation models and to determine whether the system conforms to design specifications.

"Laboratory and static tests by the developer are insufficient.

"It is also necessary to conduct actual missile firings to test key aspects such as release, acquisition, propulsion, tracking, trajectory, and aerodynamic and separation characteristics.

"OTR can be described as a giant open-air laboratory in which tests are executed with the highest degree of accuracy and reliability in a controlled environment. The ability to process, analyse and interpret the extremely large volume of data gathered during a test and then to produce a meaningful report for the client makes the test range a valuable partner in developing advanced weapon systems."

OTR, according to Malan, believes that more streamlined weapon system testing will reduce the time required for developing and producing systems for operational requirements.

Because of the application of the latest technology in optics, telemetry, radar, data processing and communications, more reliable and complete data can now be accumulated in fewer tests.

Three main measurement tests are performed at OTR: internal, external and environmental ones.

"Internal measurements are done by encoding the output of on-board sensors such as accelerometers and inertial units, and transmitting these to telemetry receiving stations on the range where data is decoded, processed (some in real time) and presented graphically.

"The raw data is recorded on high-speed recorders for eventual off-line detailed analysis. Typical parameters

measured are temperatures, vibration, body angles, mechanical motions and power levels in the missile system," says Malan.

"External measurements are performed by sophisticated electromagnetic and electro-optic measuring systems.

"These are concerned primarily with trajectographic data gathering and photographic documentation of the entire flight of a weapon.

"Aspects such as position, velocity, acceleration, body orientation and roll rate of a missile are measured accurately for detailed off-line data reduction. Photographic documentation is essential for ascertaining a weapons' behaviour during particular occurrences such as release, separation or destruction.

"These measurements are conducted using cinetheodolites, high-speed cameras, Doppler measuring systems and tracking radars.

"Environmental measurements refer to recording meteorological profiles during tests and the dissemination of that data which may influence weapon system behaviour.

"Refraction errors in electromagnetic and electro-optic measurements are thus corrected and aerodynamic coefficients of weapons calculated.

"Air and maritime search radars as well as an electromagnetic spectrum surveillance system are used to monitor the test environment further."

OTR's manager says that in support of this philosophy of comprehensive measuring, numerous points were prepared over the area of about 30,000 acres where mobile and fixed equipment are deployed. Test facilities are deployed according to a detailed test design devised specifically to meet client requirements.

The deployed facilities form an array of sensors connected to the control centre by an extensive and sophisticated communication network carrying speech, video, data and timebase information.

Says Milan: "Physically, the network comprises an optical fibre system supplemented by microwave links to the deployed equipment,. About 1,6-million metres of fibre are used.

"A central timebase system provides accurate synchronisation of instruments on the range. All data-gathering during a test is time-stamped to ensure precise data-matching occurs. "During a test countdown, the timebase is used to provide an accurate countdown time for event synchronisation.

He continues: Advanced computer systems enable complete real-time control of every sensor system and processing of the large volume of data. "Extensive use is made of suites of computer programs and mathematical models during the complex data analysis and reduction process. Specialised integrated computers also form part of most of the sensor systems."

OTR staff, according to Malan, are justifiably recognised for their pioneering work in establishing new standards for measurement technology in South Africa.

"The skills and experience the engineers, scientists and high-level technicians acquired here are of singular importance to the armaments industry.

"No doubt, the standards set here will eventually also benefit related high-technology industries in other areas.

"Today, Overberg Test Range is on par with similar establishments anywhere in the world. "Though creating and operating such a unique and highly sophisticated facility is both cost and manpower-intensive, it is, on account of its critical role in extending our armaments industry, an essential investment in South Africa's survival and well-being."

Infoplan Subsidiary

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 26

[Article: "Holistic Information Technology Services"]

[Text] A diverse, holistic information technology (IT) capability in support of the Armscor group and the SADF is offered by Infoplan, Armscor's specialist computer and information technology sibsidiary.

Since its establishment in April 1978, Infoplan has become an acknowledged leader in the South African computer industry primarily because of its commitment to: sound quality ethnics; consistent, high-level personnel development; and assimilating and developing new hardware and software technologies for the benefit of Armscor, the SADF and other users.

According to general manager Joubert "J.J" van Rensburg, Infoplan's primary mission is to deliver products and services to support and enhance clients' effectiveness and efficiency through optimal computerised information technology.

Its main clients are Armscor and its subsidiaries as well as the SADF. The organisation renders services of national strategic importance to meet client information technology requirements.

Infoplan's five primary objectives are:

- to assist clients in procuring information technology, including hardware and software;
- to establish, manage and maintain a technical support infrastructure to facilitate information technology usage;
- to establish and enhance information technology skills and knowledge among Infoplan personnel, clients and associate institutions;
- to execute activities in support of the company's internal management and operational processes; and

- to structure the future for survival, including research and development as well as long-term planning to meet swiftly changing client needs.

Says Van Rensburg: "The company offers a wide spectrum of information technology skills such as business analysis, project management, systems analysis and design, programming, data base design and administration, computer operations, quality assurance, hardware maintenance and systems audit.

"The systems developed by Infoplan range from highly specialised and complex real-time systems to basic systems in applications such as financial, medical, personnel, project management and manufacturing, to name a few."

Infoplan services embrace four main areas: consultation, acquisition, applications and support services.

The consulting field embraces managerial, functional and systems-related consultation necessary to support a client in applying information technology effectively according to his specific business circumstances and requirements.

The acquisition function entails sourcing and supplying equipment, software and resources for clients. Applications embrace the entire life cycle of an information system, from need determining, design and development, to final installation.

Infoplan's extensive support services assist clients in implementing and operating IT systems, including the necessary personnel training.

Reputed for its staff loyalty and low staff turnover, especially when one looks at the dominant IT industry trends, Infoplan's 1,600-strong staff includes a wide variety of well-equipped IT specialists.

Says Van Rensburg: "Infoplan believes in creating conditions under which individuals may reach self-actualisation and therefore places emphasis on career opportunities and development of individuals and their careers."

"The company's training facilities, available to client and in-house personnel, compare with the best in the country.

"Computer-related and manpower development courses are presented. Facilities include an auditorium, lecture rooms, terminal rooms -mainframe-linked or PC-driven - and syndicate rooms.

"The lecture rooms are equipped with computers and the self-study centre accommodates students in their preferred media—video, audio, microcomputer or interactive video instruction."

He adds: "The unique nature of our clients inspired Infoplan to find unique solutions for their needs and to keep them at the forefront of information technology.

"Exciting new products, features and services are constantly being added to Infoplan's already wide spectrum of resources."

According to Van Rensburg and his senior colleagues, one of the major growth areas in Infoplan's operations is in the burgeoning field of manufacturing resource planning (MRP) for production-based or orientated Armscor subsidiaries.

The goal of using MRP software is to optimise all key resource areas in modern manufacturing, including inventory control, material usage, quality assurance, and production planning, costing and optimisation.

Infoplan has also been instrumental in helping the SADF's medical fraternity to establish a medical data base of all SADF servicemen, including details such as health problems like allergies.

"Such innovations increase the SADF's efficiency in maintaining and applying servicemen records, especially when it comes to potentially sensitive or complex health-related matters," says Van Rensburg.

Musgrave Manufacturers

34000458A Johannesburg ENGINEERING WEEK in English 1989 pp 26-27

[Article: "Musgrave: The Art and Science of Hand-Crafted Rifle-Making"]

[Text] Armscor's armaments capability extends as far as the design, manufacture and marketing of a diverse range of sporting rifles primarily for the private sport and hunting enthusiast, including the lucrative export market.

These rifles are produced by Musgrave Manufacturers and Distributors at Bloemfontein.

Musgrave—an Armscor affiliate since 1971—was founded in 1950 by Ben Musgrave, senior and his son, Trevor. Later, the other son, Ben Musgrave, junior joined the firm.

Musgrave's 10 sporting rifle models are manufactured in a large modern plant employing about 220 workers and producing about 6,000 hunting rifles a year.

A growing percentage of the Musgrave production is exported.

The Musgrave model 90 range is the company's "flagship" sporting rifle range comprising three models, the deluxe, light and standard versions. Six popular calibres are produced in each model (243, 308, 270, 30-06, 7 times 57mm and 7 times 64mm).

The company's second main production rifle range is the Musgrave K98 range, also available in deluxe, light and standard versions. These models have the authentic Mauser action fitted with the renowned Musgrave

barrel. The attractive walnut stock completes the rifle to fulfil a popular market segment's needs.

This range of rifles is also available in the above-mentioned six calibres.

To satisfy big game hunting requirements in South Africa and elsewhere, Musgrave rounded off its stable of model 90 action rifles with the Musgrave Magnum rifle.

This rifle is available in the most popular big-bore calibres, i.e. 375 Holland & Holland, 300 Winchester Magnum and 7 mm Remington Magnum.

A breakthrough was achieved in the small-bore rifle market when Musgrave introduced its ambidextrous Ambidex 0.22 LR rifle in 1988.

Musgrave was also lauded for this neatly designed, small-bore rifle when it received a Cullinan Design Award in October last year (1989).

The company's three-model approach is also found in this small-bore rifle.

Another popular production rifle is the world-famous RSA 7,62mm calibre target rifle. Despite sanctions and embargoes, the Musgrave RSA target rifle has found its way to more countries abroad than any of the other Musgrave rifles.

This is largely attributable to its sturdily designed single-shot action and the renowned target barrel produced by the push-button method. This barrel rifling process is used on all Musgrave hunting and sporting rifle barrels.

Connoisseurs find Musgrave's custom rifle department more than willing to supply a hand-crafted rifle with any custom feature to fulfil specialist requirements. Musgrave's custom workshop employs 12 highly trained craftsmen of which three are full-time metal engravers. Hand-crafted rifles of virtually any popular calibre can be built.

Only top-grade Turkish walnut is used for stocks.

Apart from custom rifles, this section also repairs old rifles to their original usefulness, rebarrels worn barrels, restocks, and converts old military 303 rifles into sporting hunting rifles, among other specialised tasks.

This workshop also produced a limited number of Anglo Boer War commemorative rifles in 7 x 57mm calibre. Each of the 10 rifles was made to commemorate a particular battle.

All were commissioned by the War Museum of the Boer Republics in Bloemfontein.

Says Abie Koch: "The strongest capability on the metal-cutting side of the factory lies in the barrel manufacturing process.

The three main operations are the unique gun-drilling capability, the diamond honing of the bore to exact specifications, and the external barrel profiling.

"Our modern CNC machines are fully programmable and cut metal at high speeds to fine tolerances.

"Another strong capability is the woodworking machines. The first important wood-cutting machine is the multi-spindle copy-turning machines.

A rifle stock is copy turned to close dimensions needing only nominal final finishing.

"The second machine is a high-technology machine, fully programmable for simultaneous movement in five axes, that is the X, Y and Z axes as well as the A and B rotary axes.

"This machine is used for the inletting work on the stock for the final fitting of the rifle metalwork into the stock."

Musgrave's chemical section features three modern chemical processes, including a gun-blueing process for blackening metalwork.

Aluminium rifle components are hard-anodised and blackened for wear-resistance and aesthetics, respectively.

A further capability at Musgrave is its computerised hard-chrome plant. Hard-chroming of barrel bores is an advanced and intricate technology.

In the field of barrel manufacture not many countries or rifle manufacturers have successfully applied this technology.

Barrels with a bore calibre of 7,62mm have already been hard-chromed successfully.

Treated barrels' life spans have been doubled from 15,000 rounds to 30,000, thus improving cost-effectiveness and reliability tremendously for the user.

Says Koch: "Musgrave's master engraver of metal components is recognised worldwide.

"Artistic metal engraving is enhanced by silver and gold inlaying as well as deep-relief engraving of whatever designs customers require."

Turning to research and development, he says: "Musgrave's research and development department is continuously striving to either improve existing products and to develop new products.

"The Musgrave Ambidex 0,22 LR rifle, for example, originated from this department.

"Other development projects are also in the design stage and will be announced at appropriate dates in the near future."

Adds Koch: "To achieve a proper design, it is essential that a product advances through all the relevant development stages.

"The first triggering mechanism to start a development project is a user's requirement specification (URS) document.

"This document specifies all user needs to ensure all requirements are designed into the product."

Musgrave applies seven engineering process phases: the conceptual, experimental, advanced development, engineering development, qualification, production and product support phases.

The conceptual phase entails grouping and defining user requirements into engineering terms and concepts. Mock-ups and/or conceptual drawings are generated in this phase.

In the experimental phase, the first prototype is built to determine certain feasible concepts and requirements.

In the advanced development phase, certain concepts are tested and evaluated, and advanced functional models are built to higher order engineering drawings.

The engineering development phase entails building models or prototypes on production machines to determine the production readiness.

In the qualification phase, a select number of rifles are qualified under stringent controls.

In the production phase, full engineering drawings are finalised and placed under configuration control for series production.

All tools, jigs and fixtures are tested and evaluated to ensure correct final production.

The product support phase primarily entails maintaining and supporting the designed product over its useful life either in the operational environment or during workshop repair.

The supply of spares, catalogues and training equipment, for example, is part of this phase and is at most times neglected in the commercial environment, according to Koch.

All development projects undergo the corporate-applied systems engineering approach to ensure no development phase is neglected.

Explains Koch: "Strict quality assurance and statistical quality control are Musgrave's watchdog. Process control and process capability studies are consistently performed to ensure all rifles function correctly and reliably.

"Each and every rifle manufactured by Musgrave must, according to law, undergo a high-pressure proof test.

"This entails firing a proof cartridge delivering a 30 percent over-pressure to that obtained in normal use. This test is performed by an SABS [South African Bureau of Standards] official and every Musgrave rifle carries the SABS proof mark.

"Apart from this test, each and every rifle is also test-fired to ensure reliable feeding and extraction as well as to determine the rifle's inherent accuracy."

Turning to the international market, Koch says Musgrave has participated in the renowned IWA Show in West Germany for two consecutive years and will attend it again next month.

At this show, where 450 exhibitors display their prime quality hunting rifles, Musgrave has compared favourably with the world's best rifle producers.

The company has also participated successfully at Italy's EXA '88 Sporting Arms and Accessories Show.

Comments Koch: "Employees have a continuing urge to strive for perfection and high-quality products as part of a concerted company bid to penetrate lucrative markets outside of South Africa.

Eloptro Affiliate

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 28

[Article: "The Electro-Optics Leader"]

[Text] In 1974, Eloptro was established with the specific objective of supporting existing military optical and electro-optical systems as well as the manufacture of new equipment. As an Armscor affiliate, Eloptro's electro-optical products meet the highest international standards.

Growth has been remarkable. Eloptro has grown from a manufacturer producing under licence to a fully-fledged product-house with all the relevant systems and manufacturing capabilities. The company is thus well-situated to operate as a produce supplier, satisfying requirements from the concept phase, through development and production, and to the operational and logistical support phases.

Eloptro boasts a range of high-technology products including laser and night-vision equipment. The company also designs and produces electro-optical products for missile-guidance systems, sighting equipment for infantry, armoured fighting vehicles (AFV), artillery, naval and aircraft applications. In addition specialised industrial requirements in the electro-optical field are undertaken.

In the case of infantry, this includes medium and long-distance night observation equipment, as well as night sights used in light weapons. A small hand-held laser range-finder has also been developed for specific infantry application and has been invaluable in combat areas.

Today, Eloptro is a key contributor to the SADF's requirements. Its driving force is to satisfy the complete SADF optical and electro-optical needs. Eloptro also markets its products and technology to the SA Police, local security services, selected export markets, and to the medical, steel and other high-tech industries.

In its product design and manufacture, Eloptro strives to maintain a competitive advantage in terms of both cost and technology. Products are designed to be user-friendly, rugged, modular and of the highest quality. By meeting these objectives, simple yet complete logistic support systems and services ensure high availability.

To strengthen this philosophy, Eloptro has undertaken to maintain a flexible manufacturing base, provide a full life cycle service on all products, to finance and develop facilities required for new technologies and to optimise costs. This policy ensures the technical integrity of all the company's products, allowing increased market penetration locally and abroad.

At Eloptro product development occurs against the technical objectives stipulated in the development specification of the product base lien. This specification is derived from the systems-engineering process. In this process, the user's requirements are processed to a preferential specification whereby all practicable production options possible are evaluated against the client's weighted value system.

To achieve this, a good optical modelling capability is critically important. Over the years, Eloptro has acquired an outstanding capability in this discipline. The ability to simulate a wide range of optical scenarios and to compare parameters with each other is well-established.

Eloptro's technological and manufacturing capabilities include specialised glass, optical elements, thin-film coatings, image-intensifier tubes for night-vision equipment, and mechanical and electronic system assembly and testing as well as sustained logistical field support.

The company's extensive optical lens production facility is one of the few in the Southern Hemisphere, and its products are said to be comparable to those produced anywhere in the industrialised world. This facility's successful operation demanded the creation of a South African optics apprenticeship course in 1985.

Optical elements typically lose about five percent of light transmission due to reflection. In complex, multiple-element optical systems, potential light loss is therefore significant. Anti-reflection thin-film coatings are applied to reduce this loss. The process is conducted under an extremely high vacuum using state-of-the-art equipment. The thin film coating technology is also used for applying a wide range of specialised narrow-band filter-, polarising- and reflective-coatings.

Eloptro's optical design capability in the product development phase is another unique development capability. In this process, combinations of some of the 242 optical glass types are used.

Each glass has a different refractive index and dispersion combination. The number of optical elements (lenses) used in a system, their curvatures, thicknesses and diameters, and axial spacing are the variables optimised for each product. Powerful optimisation routines and disciplines are indispensable for this process.

Focusing on another specialist Eloptro product development areas, the company's image-intensifier tube (IIT)—the 'eye' of night vision equipment—intensifies ambient moon or starlight by about 40,000 times, thus providing full manoeuvring capability in the dark. A highly complex IIT is produced in a near-surgically clean environment totally dedicated to this product.

The IIT incorporates advanced fibre-optics and electron-accelerator principles. The IIT production facility was also installed at a relatively early point in Eloptro's development.

Eloptro also has a comprehensive plating and painting facility for protective-coating of mechanical components. A wide range of anodising, plating and paint formulae are employed, some of which are applied in eight to 15 micron thick layers. Formulae are developed specifically to provide long-term product protection to comply with stringent military standards.

Eloptro recently established technology in holography for addressing certain products' specific requirements. Holographic optical elements (HOEs) provide some unique solutions where mass, cost and interference filtering play an important role.

Regarded as a leader in appalied laser technology, Eloptro produces a wide range of laser products. Fast, accurate range-finding is a critical aspect of fire-control systems. The associated electro-optic and electronic development capabilities are firmly established to the extent that the modularisation is being incorporated at the design stage, thus resulting in fast configuration changes.

The company's engineering management infrastructure includes such disciplines as systems engineering, optical, electronic, opto-mechanical and mechanical engineering design. The essential ability to design and develop both products and systems to clients' specific requirements is thereby ensured. Project management plays an indispensable role in controlling the design and development phases.

In the optical modelling or simulation programmes, the relevant properties of the subject, atmosphere, spectral environment, optical systems and the 'eye' or electro-optical detector are all evaluated thoroughly, as are other environmental factors such as shock, vibration, humidity, dust, chemicals and corrosion. Although

generic in the armaments industry, modelling capability technology is contractor-specific.

Opto-mechanical design has come into its own in housing complex optical systems into products. Through scientific materials selection, housing (mounting) methods and structural analysis, predetermined parameters for temperature compensation, mounting, integrity, mass optimisation and functionality are achieved.

This discipline has presented the investment-casting and close-tolerance machining industries with demanding challenges to the extent that new capabilities in these supportive private sector industries have been established.

In developing, industrialising and launching new products, the ultimate test is that all products meet operational requirements. Extended test and evaluation programmes are thus required. These tests are scientifically developed and specified throughout with acceptance and failure criteria, and include both field and laboratory tests. Eloptro has the necessary laboratory test facilities.

Leading-edge products and components are manufactured, assembled and tested at Eloptro. Scientists, engineers, technicians and artisans combine their skills through all production and assembly facets, ensuring inherent quality in a good product.

All Eloptro production is conducted using an efficient MRP (manufacturing resource planning) system. JIT (just-in-time) manufacturing concepts have also been introduced to improve quality, reduce scrap inventory, and to shorten manufacturing lead times.

An excellent metrology division for optical evaluation has been established. The division's services apply to the total range of wavelengths applicable to the electro-optical industry.

An extended interferometer infrastructure with the capability of characterising wavefront variations to 1/20 wavelengths (around 633nm) has also been established.

Configuration management forms a central technical management system which monitors product base line movement. Configuration management is activated at the earliest possible stage in the development phase to effectively monitor efficient development of the data pack.

Ultimately, along with qualification, the product base line is formally verified, followed by the manufacturing base line at the end of the industrialisation process.

Eloptro recently established a repair facility to ensure fast and efficient logistical support to existing products.

This development places the company in the product house category, capable of supporting all of its products throughout their life cycle—a critical requirement in the armaments industry.

The future of military electro-optics is almost unlimited, and the combinations of the various new electro-optic technologies will provide a vast new array of capabilities for military and industrial appalications.

The high level of technology required for designing and producing electro-optical systems presents a working paradise to scientific, engineering, computer and similarly orientated people in an exceptionally stimulating environment.

Eloptro is a mature company capable of providing the design, development, production and support of the electro—optical product needs for the SADF and industry.

Electro-optics is an evolving technology being applied increasingly to solve many military and industrial problems. Eloptro is well-equipped to fulfil these needs having developed the newest technologies in pace with the rest of the world.

To continue providing sales growth and to expand requirements for existing products, other markets for these products are being pursued. To date, Eloptro has not had the resources properly to address the commercial needs, locally and abroad, for complex electro-optic products, or for the application of its specialised processes to everyday products.

This market is now receiving a great deal of attention. South Africa is in a major growth phase for local industry and Eloptro can play an important role in assisting this growth away from mining and agriculture to an industrially based economy.

To meet these challenges Eloptro will continue to stay abreast of new technologies, keep prices down and, above all, refine customer services.

Armatron Facility

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 29

[Article: "Surging Towards New Heights in Aerospace Defence Systems"]

[Text] The systems house primarily responsible for translating client specifications into functional engineering designs in the aerospace industry is Armatron, led by facility manager Dr P. I. Bekker.

Armatron—like sibling Armscor facilities Gennan and Milistan, for example—is a facility or internal company falling under the control of the corporate Engineering Department.

Registered as a company with a board of directors drawn from Armscor's top management team, Armatron uses corporate facilities and services but must be run as a self-financing organisation.

It is an offshoot of Gennan and was established becuse of the growing need for a separate, dedicated team to work

on complex aerospace defence systems, primarily for the South African Air Force (SAAF).

Committed to modern business principles—along with its pursuit of excellence in advanced aerospace technology, Armatron upholds the ALERT business principles of adaptability, leadership, enterprise, relevance and trust. Adaptability means being able to adjust to changing client (primarily SAAF) needs.

While leadership, enterprise and trust are quite self-explanatory, relevance relates to the need for Armatron to remain focused on its mission and thus always productively client-orientated.

Says Bekker: "Armatron, in tune with the corporate culture that has evolved, can contribute considerable technical expertise in developing appropriate aerospace defence systems in terms of performance, supportability, user-friendliness and cost-effectiveness.

"Our skills—rooted in engineering and science disciplines—are in areas such as mission analysis, functional performance modelling, operational modelling of concept designs, and logistic support concepts and analysis, using an optimum synergy between all team members.

"Armatron's objective is to contribute at the highest system level to the engineering needs of the Air Force's weapon systems.

"These must be fully integrated with the user's operating system to ensure SAAF operational needs are translated effectively into acceptable technical specifications."

Kentron Systems

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 29

[Article: "Providing Complete, Advanced Guided Weapon Systems"]

[Text] Kentron's intelligent, combat-proven missile systems—all products of its drive for total self-sufficiency—have made a major contribution to South Africa's defence requirements over the past decade.

If the word "Kentron" sounds like Greek, it is. Meaning "sting" or "sharp point", it aptly conveys the company's main activities: the design, development, testing, integration, a production and after-sales support of sophisticated missile and related defence systems.

According to Kentron general manager Freek Naude, the subsidiary supplies the following systems and products to the SADF: long-range weapons such as the Seeker remotely piloted reconnaissance system; short-range weapon systems like the Kukri air-to-air missile system; trackers like sights and missile seeker heads; and inertial systems such as gyros and navigation systems.

In fact, it embraces the complete spectrum of ground-to-ground, ground-to-air, air-to-ground and air-to-air missiles.

"Kentron," he adds, "not only makes weapons but also complete weapon systems. We act mostly as the main contractor for the supply of a total system.

"For example, and air-to-air missile system will include a missile plus helmet sight, launcher and other aircraft-mounted equipment.

"In the process, we naturally use many private sector partners and sub-contractors with the ultimate responsibility resting with Kentron."

"It is also important to stress that a product's life cycle can extend to 30 years, thus demanding a large degree of post-production product support, including training for system use and second-line maintenance. Like all Armscor companies, we maintain close and constructive ties with the end-user."

The development of a new or enhanced missile system, for example, entails a vast technical team effort to ensure prototypes comply with end-user specifications and requirements.

A missile therefore spends a considerable amount of time on the drawingboard and on a dedicated computer modelling program which covers flight simulation before final prototypes are site-tested at one of the corporation's test sites.

To handle its advanced and diverse products and services, Kentron employs about 1,800 people of which almost 1,200 are technically skilled, says Naude.

Many of these specialists are involved in quality control and assurance functions, a clear indication of the commitment to sound quality management and the pursuit of advanced weaponry systems.

Established in 1978, Kentron moved into its own dedicated plant at Irene, south-east of Pretoria, two years later.

Nestled on almost 200 hectares of rural ground, Kentron provides an ideal environment for dedicated scientific and technical work of a highly sensitive nature.

Kentron's scientific and technical roots, however, date back partly to 1963 when the old CSIR [Council for Scientific and Industrial Research]'s Rocket Research Institute (which became the National Institute of Defence Research a year later) began work on rocket and missile research and development.

The first South African rocket system was unveiled in 1971 but did not undergo commercial production because the SADF required a more sophisticated system. By 1977 the country's first commercially produced system was launched.

Comments Naude: "We believe we provide our employees with a unique opportunity to realise their

ambitions. And we know they are exposed to each of the most important technical disciplines, especially in electronics and mechanics.

"Electronic disciplines practised at Kentron include: analogue electronics such as power systems; digital electronics, including microcomputers; electro-optics such as seeker heads, proximity fuses and sights; and radio frequency systems for radar, sensors and other communication equipment.

"Mechanical disciplines embrace facets such as structures, aerodynamics, fine mechanics, general mechanics, opto-mechanics and pressure systems.

"It is important to stress here that we try to promote the best possible quality of life for employees, including meaningful, long-term career opportunities.

"After three years' experience, an engineer-in-training can register with SARPI.

"At senior level, he can decide whether to go into line or programme management or continue in the technical field and specialise.

"In either direction, an engineer has the opportunity to progress to the highest level.

"A large amount of Kentron's budget is committed to establishing new skills. We have to ensure we remain at the forefront of technology becuse in the armaments industry only the leader has a good chance of sustained success."

As for the future, says Naude, the drive to produce "more for less" will be sustained in the hope that Kentron will continue producing highly sophisticated systems cost-effectively by international standards.

Role of Procurement

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 30

[Article: "Co-Ordinated Procurement Is Vital to the Customer"]

[Text] Procurement is the word that best encapsulates Armscor's functions—and in the South African scenario it has meant since the corporations' inception the role of procuring all defence systems and equipment of the Defence Force (SADF), Police (SAP) and the Prison Service.

Armscor, therefore, is not charged entirely with complete responsibility of establishing in-house manufacturing facilities. In addition to its production subsidiaries such as Atlas, Eloptro, Kentron, Naschem, Pretoria Metal Pressings and Somchem, Armscor engages the service of about 975 private sector companies, each of whom is contracted to produce certain systems, products or subsystems according to Armscor objectives, specifications, designs and quality assurance parameters.

This has always been and will remain Armscor's main objective to ensure optimum private sector participation while avoiding unnecessary duplication of production infrastructure in an economy where unfavourable economies of scale often hinder the potential to attain the desired growth rates.

Said an Armscor procurement spokesman: "In simple terms, we ensure clients such as the SADF get what they need, on time, within budget and according to all design and performance specifications finalised between Armscor and the clients.

"We have to be able to determine what the user really requires in terms of functional needs, time parameters and budgets, for example, and then ensure specifications are developed ultimately into a finished product that is fit for its intended purpose.

"Procurement embraces everything from specifications right through to research, development, industrialisation, manufacture, quality control, project management—including administration, personnel and finances—and post-production support and training."

In the case of maintenance, for example, the user is charged with maintaining systems and products such as aircraft but Armscor, through its Procurement Department, has to ensure the user has the necessary training, technical manuals and spares, for example.

Where skills are lacking for the development of a new system or product, Armscor is responsible for ensuring those skills are acquired or developed in the most cost-effective manner so that client objectives are met economically and effectively.

The procurement function, being all-embracing, demands a considerable empathy for the client and his operational requirements, including an understanding of real-life defence situations.

"We have reached the point where, for example, our successes mean that quality is built into a product right from its inception, thus assuring the user of a reliable, cost-effective solution to his needs.

"We can also claim that our suppliers rate among the world's best. But we'll have to sustain our efforts to eliminate any technology lags," he said.

Vehicles, Weapons

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 30

[Article: "Top Guns and Other World-Class Systems"]

[Text] Armscor can compete with the world when it comes to designing and developing combat-effective military vehicles and weapon systems, says Jaco de Jager, general manager of Armscor's Vehicles and Weapons Department.

The Vehicles and Weapons Department comprises five divisions:

- support divisions for vehicles such as Samels, tankers, supply and associated vehicles;
- protected vehicles division for personnel carriers such as Casspirs;
- mobile fighting vehicle division for such vehicles as the Eland, Rooikat and Ratel;
- engineering division for such requirements as mine-clearing equipment; and
- specialised artillery systems divisions (G5 and G6 systems).

The department's primary function, according to De Jager, is to co-ordinate the corporate tasks of specifying, designing, developing, industrialising, manufacturing, testing and supporting military vehicles and specialised weapon systems. Its tasks include contract negotiation, subcontractor appointment and liaison, and project management.

According to De Jager, this department's project roots go back to 1964 when South Africa first developed the Eland, based on French designs. In 1976, work began on the infantry fighting vehicle, the Ratel, which went into production two years later.

The next major project was the development of the impressive Rooikat armoured car which has played a major role in the SADF's infantry support requirements.

"At the outset, we were adapting imported designs to suit local conditions. But we have, in line with Armscor's development, reached the stage where we can handle complete projects right from the initial concepts through to final production, quality control and support.

"In terms of artillery vehicles, we started serious local design work in 1976, first in conjunction with overseas technology partners and then, after 1977, on our own. The two key products we produced in this regard were the G5 howitzer and its motorised variant, the G6. These two systems are rated as being among the world's finest, especially when one considers the wide variety of terrains in which they can perform effectively."

The G5, with base-bleed projectiles, can fire accurately up to a range of 40 kilometres at sea-level. This flexible weapon system is an all-in-one traditional gun, howitzer and mortar. It uses a wide variety of projectiles to suit specific combat needs. A 10-tonne vehicle can tow the G5 at 90 kilometres an hour.

The motorised G6, a sophisticated artillery system renowned for its strategic and tactical mobility, can hurtle into action at speeds greater than 80 kilometres an hour. Once locked into its combat position, it takes a mere 60 seconds to have the first lethal round soaring towards the enemy target. It shares the same accuracy as the G5 and could, for example, be fired from central Pretoria towards Johannesburg with an almost 100 percent certainty of being able to strike the rugby field at Ellis Park Stadium by the third round.

There's virtually no chance of running this formidable dinosaur on empty: it can roam for 600km at an average speed of 80km/h without a fuel stop. The G6 can be manoeuvred up 50 degree slopes and ease over ditches a metre wide. If need be, it'll flatten a large tree trunk thanks to a smartly designed, high-strength steel hull.

Regarded as being extremely crew-friendly, the G6's full air-conditioning system keeps a six-man crew fresh and alert in any climate and combat situation. The hull's armour steel protects the crew from small arms and artillery shrapnel. An anti-tank mine may inhibit the vehicle but the crew remains safe.

Another successful project is the Valkiri motorised 127mm medium-range rocket system that "shots and scoots" in many environments with sure-fire accuracy and lethality over a 1,500 square metres areas. Its radio proximity fuse operates as a ground surface proximity detector and has exceptional frequency agility.

It is effective in the eight to 22km range and can be deployed either on its own or in a support role against area targets such as camps, troop concentrations and soft-skinned military convoys. An electronic fire unit inside a four-wheel-drive launch vehicle ignites the rockets singly or in ripples of between two and 24 to achieve average burst heights of 10m.

De Jager said: "Armscor has been considering additional export opportunities for these products, including our mine-protection equipment and vehicles, for which we are particularly renowned internationally.

"In terms of new projects, we are always looking at new ideas and upgrades. There is a constant challenge to improve operational performance and functional designs."

Electronic Excellence

34000458A Johannesburg ENGINEERING WEEK in English 1989 p 30

[Article: "The Bold Quest for Electronic Excellence"]

[Text] The science of electronics has moved rapidly to the fore of armaments technology internationally and plays an increasingly indispensable role in determining the design and performance of many weapon systems.

Armscor is no exception with its wide-ranging and sophisticated electronic engineering capabilities established in the private sector by its Electronics Department.

"We have certainly developed our skills and resources significantly to be at the forefront of electronic armament systems and I foresee a sustained quest to achieve

excellence in a wide variety of electronic fields," said Hans Hoff, a general manager of the Electronics Department.

"As technology evolves, warfare becomes more sophisticated and the military clients more demanding, electronics will play an increasingly important role. It's a particularly challenging and stimulating field in which to work at Armscor and that, in itself, has given us a great sense of dedication and purpose.

"Our specialised mission—working across the broad spectrum of modern electronics—requires tremendous dedication and often a sense of great urgency in designing, developing and manufacturing electronic systems, whether they are for naval, air force or army requirements."

He continued: "While much of what we do is run-of-the-mill, there are some particularly demanding high-tech projects. But, whatever the project, we believe in maximum delegation, ensuring the specialists are given the best conditions in which to perform and create pragmatic solutions to defence requirements."

The realities of the recent Southern African conflicts involving SADF units soon brought home the need to optimise existing technologies. In many other areas, the challenge lay in developing completely new systems, some of which later emerged as "world firsts" for South Africa. A classic example, according to Hoff, is the local development of a frequency-hopping radio communication system.

Frequency hopping radios change frequencies randomly at a lightening speed of many times a second, thus ensuring that even the most astute enemy intelligence personnel will have great difficulty intercepting messages and posing a threat to national security.

"Electronic warfare is another area where electronics play a vital role. For example, the need to protect aircraft against enemy radar weapon systems by using appropriate counter-measures.

"We have to try to remain one step ahead of the enemy because as you develop a new, improved system so, too, does he, and vice versa. It's counter-measure for counter-measure so the more intelligent, swift and reliable your electronic systems, for example, the greater your chance of winning in electronic warfare," he added.

On future systems, Hoff commented: "It's difficult to specify but there will be great changes. What's certain to me, however, is that we will have to sustain our research and development efforts in peace time.

"Your larger, more sophisticated systems take a long time to develop so there's no wisdom in waiting for the next war before undertaking your R&D. I believe the group's entire electronics development momentum will be sustained even if defence budgets are cut substantially.

"We see the near future, at least, as a time to consolidate and optimise our resources and to plan wisely for the future."

Rooivalk Helicopter

34000458 Johannesburg ENGINEERING WEEK in English 1989 p 32

[Article: "Atlas Unveils New Rooivalk Combat Support 'Copter"]

[Text] Conceived in 1984, the Rooivalk was designed, developed and manufactured by Atlas and its subcontractors to fulfil the SA Air Force's requirements for a versatile, highly mobile helicopter that can be equipped with sophisticated weaponry.

Says an Atlas spokesman: "Depending on the role required, the Rooivalk may be equipped with air-to-ground or air-to-air missiles, rockets and cannon. A major design criterion was to develop a generic weapons platform to enable the Rooivalk to support highly mobile ground forces such as squadrons of Rooikat armoured fighting vehicles.

"When one considers the South African aircraft industry is only 25-years-old, the Rooivalk's development is significant. It demonstrates that South Africa has the expertise and facilities to become an important developer of high-technology aeronautical systems."

During 1985, Atlas few the XH-1, its first prototype attack helicopter which was based on the French Alouette airframe and drive system. This was followed in 1986 by the XTP-1, a flight test platform developed for testing sub-systems for the attack helicopter programme.

The Rooivalk's development involved 600 engineers, designers, technicians and skilled artisans over the past five years. It has a maximum take-off weight of more than eight tonnes and a top cruising speed of 145 knots over a maximum range of 400 nautical miles.

Telecast Engineering

34000458 Johannesburg ENGINEERING WEEK in English 1989 p 32

[Article: "High-Tech Casting Expertise Ensures Self-Sufficiency"]

[Text] The South African aerospace and armaments industries' high-precision casting requirements are largely met by Telecast Engineering, an Armscor subsidiary formed in the mid-1970s to promote national self-sufficiency in this specialist field.

Telecast's sand foundry for aluminium and magnesium alloy castings was commissioned in 1976 before a high-precision investment casting plant was installed. A precision closed-die forging plant was commissioned in 1983.

Said a company spokesman: "It is Telecast's policy to keep abreast of state-of-the-art developments in supplying a range of high-tech castings, forgings and all-round metallurgical expertise. This not only satisfies local industry's needs but also meets our import-replacement requirements and possible export opportunities.

"All manufacturing areas are supported by the most advanced process control equipment and techniques in which process parameters are monitored continuously. Non-destructive testing is conducted as an integral part of the process control function with on-site facilities such as X-ray, die penetrant, magnetic crack detection spectrographic metal analysis and mechanical testing."

He continued: "To support the rapid advances in casting technology, Telecast has sustained research and development programmes in co-operation with organisations such as CSIR [Council for Scientific and Industrial Research]'s Division of Mateirals Science and Technology.

"We aspire to maintain optimum expertise and technology to ensure Telecast's competitiveness in the international market. Technological development programmes will, therefore, remain a priority."

Telecast Engineering, he said, had supplied industry with high-precision components over the past 14 years. The positive relationships and mutual co-operation established in sharing the technologies developed will continue to be strengthened and expanded.

Industrial Development

34000458 Johannesburg ENGINEERING WEEK in English 1989 p 32

[Article: "Industrial Development Focus"]

[Text] Since being more market-driven and client-orientated, Armscor has devoted considerable attention to its industrial development responsibilities, thus ensuring the armaments user benefits from the best possible industrialised process and other resources.

Armscor's vast industrial development function is overseen by general manager Johan Koorts. He told ENGINEERING WEEK that because about 150 private manufacturers and suppliers help to fulfil the corporate procurement tasks of developing and supplying appropriate weapon and vehicle systems, there is great need for a well-planned and co-ordinated industrial development and optimisation programme to ensure all projects operate smoothly with the least time and cost wastage, and without sacrificing the most stringent quality requirements known to modern South African industry.

Various programme managers reporting to Koorts oversee individual projects and production categories and ensure no stone is left unturned in the quest for optimum industrialisation. These decision-makers' two primary responsibilities are to: negotiate and place orders; and co-ordinate industrial suppliers. Where, for example, necessary technologies for a new system are not available, they ahve to ensure these can be found and implemented effectively with the necessary levels of training and support.

This industrialisation process, said Koorts, ensures Armscor is not burdened with the need to develop too many thousands of skills as well as the necessary manufacturing infrastructure. While there is a tendency to create sole-suppliers and monopolies, especially at the high-tech end—a trend practised elsewhere in the world's armaments industries, Koorts stressed every measure possible is taken to ensure acceptable free enterprise practices are sustained and that the client incurs fair costs only.

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